# EXHIBIT 2

**REPORT KINGSTON COAL ASH**
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**December 7, 2020**

## I. Introduction

This report reflects my overall assessment of the industrial hygiene practices at the Kingston Coal Ash Recovery Site (Kingston Site) from 2009 through 2014 and the failures of Jacobs Engineering Group, Inc., (Jacobs) to adequately protect the workers on site from excessive exposures to coal fly ash. In addition to this General Report, I have assessed, on a case-specific basis, the likely excessive exposures to coal fly ash and its constituents experienced by numerous individual Plaintiffs in this civil action and the likelihood that these excessive exposures were sufficient to result in numerous adverse health effects as supported by the medical and scientific literature. My case-specific exposure assessments are attached as Addendums to this general report.

## II. Qualifications

I am an industrial hygienist, Professor Emeritus of Occupational and Environmental Hygiene, and Director of the Toxics Use Reduction Institute at the University of Massachusetts Lowell. I hold a Doctor of Science degree from the Harvard University School of Public Health and am certified in the comprehensive practice of industrial hygiene. I have been a professor of industrial hygiene since 1981, and from 1981 to 1986, taught at the Harvard University School of Public Health. For the last 25 years, I have been a professor of industrial hygiene at the University of Massachusetts at Lowell, moving to emeritus status in September 2014. I am one of the founding faculty members of UMASS Lowell's Department of Work Environment, where, since 1987, I and other internationally renowned faculty members have prepared hundreds of professionals for careers in the health, safety, and environmental fields.

Industrial hygiene is a part of the field of occupational health and is concerned with protecting workers from exposure to hazardous substances, both chemical and physical in nature. Among other things, industrial hygiene is principally concerned with: (1) evaluating exposures of workers to hazardous materials; (2) comparing those exposures to health standards; and (3) designing control strategies when workers are exposed to excessive levels of hazardous materials.

I am well qualified to conduct this evaluation and individualized assessments based on my nearly forty years of experience in the field of industrial hygiene. My curriculum vitae is attached as Exhibit A. I have also included a list of my previous expert testimony as part of Exhibit A.

## III. Publications

I have published extensively in the field of industrial hygiene. My peer-reviewed publications from the last 10 years are included in my attached curriculum vitae.

## IV. Compensation:

I have been compensated $450.00 per hour for my time in preparing this report. This compensation does not depend in any way upon the content of my opinions.

## V. Materials Reviewed and Relied Upon

My list of materials reviewed is attached as Exhibit C. In addition, as noted in the attached list, all materials reviewed as part of my individual exposure assessments of individual plaintiffs are listed in each, which are included as Addenda to this Report.

## VI. My Understanding of the Kingston Site

The Kingston coal ash spill was one of the largest environmental disasters in the history of the United States. On December 22, 2008, around 1:00 A.M., the retention wall of a coal ash-holding pond failed at the Tennessee Valley Authority Fossil Plant in Roane County, Tennessee.[1] More than 5.4 million cubic yards of coal ash, mixed with 327 million gallons of water, spilled into a branch of the Emory River, two Emory River inlets, and the main channel of the Emory River. The release covered approximately 300 acres outside of the Tennessee Valley Authority coal ash dewatering and storage areas.

There are two types of coal ash: bottom ash, which forms in the bottom and on the sides of coal furnaces, and fly ash, the lighter and finer of the two, which contains small particles that can become airborne when dry. The coal ash produced by the Kingston plant was approximately 10% bottom ash and 90% fly ash. However, the coal ash in the slurry ponds was nearly 100% fly ash. TVA analyses of the fly ash in the dredge cell that failed averaged 32.7 % $PM_{10}$ and 8.5 % $PM_{2.5}$.[2] Because of the size distribution, it was estimated that about 33% of airborne coal ash would be inhalable or respirable.

Following the spill, cleanup was initiated by mobilizing large numbers of backhoes, amphibious backhoes, bulldozers, dump trucks, related equipment, and personnel to clear and repair affected roadways and rail lines necessary to plant operations. The heavy equipment was also used to clear waterways to allow creeks to drain that had been blocked by the coal ash release. The ash processing involved discharging ash slurry into ash disposal channels where it would flow at a rate to allow solids to separate. The solids were removed from the ash disposal channel using excavators, then subject to drying and volume reduction by windrowing. The remaining water was fed into sluice channels similar to the ash disposal channels, with solids being removed from the sluice channels and trucked over to a processing area using articulating dump trucks. Once dried, the coal ash material was loaded into rail cars for shipment. The cleanup was performed in several phases from the time of the spill in December 2008 through 2014.

Hundreds of the workers were dispatched to the Kingston site to assist in carrying out this process, with many working more than 10 hours a day, seven days a week. Because coal fly ash consists of fine particulates and can become airborne when dry, it presented an obvious and significant inhalation hazard at the Kingston site. Coal fly ash also contains a litany of toxic constituents, including the fine particulate matter itself, silica, toxic metals and metalloids (including arsenic, lead, cadmium, chromium, nickel, vanadium, mercury and radionuclides. Among these, arsenic appears to be one of the most prevalent toxic metals in the Kingston ash. An analysis of bulk samples of the Kingston coal ash taken on January 6, 2009, and analyzed by the Tennessee Department of Environment and Conservation (TDEC) found the mean arsenic concentration of

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[1] *E.g.*, https://en.wikipedia.org/wiki/Kingston_Fossil_Plant_coal_fly_ash_slurry_spill.

[2] Defined as particle with aerodynamic diameters smaller than 10 μm and 2.5 μm, respectively.

those samples to be 83 mg/kg, which is significantly higher than background levels found in soil.[3] Likewise, other toxic metals in coal ash were noted to be well above background levels found in soil.

Despite these exposure hazards, the vast majority of workers were not provided basic protection from the ash, including no respiratory protection. In fact, on-site safety managers actually discouraged workers from wearing masks or respirators on the Kingston site.[4] Photographs of workers on the site show their faces and clothes covered with a film of grey ash. Photographs, which are confirmed by deposition testimony, show visible dust and dust devils on the site and in areas where workers took lunch breaks, suggesting gross contamination of workers' food with coal ash.

The only decontamination facilities available to workers were so-called boot washes, which were nothing more than pans of water with brushes, and a limited number of containers of hand wipes near the boot washes.[5] There was no uniformly implemented protocol for removing contaminated clothing prior to leaving the site, and no protocol for decontaminating the inside of workers' personal vehicles. By all indications, there was little or no running water provided for the workers to clean themselves,[6] and there were no adequate facilities for changing clothes or showering, which would help prevent workers from carrying coal fly ash on their bodies[7] and/or clothing into their vehicles or off the site after their shifts, creating a high risk for continued dermal, ingestion, and inhalation exposure, even after each worker's shift ended.[8]

Not surprisingly, many workers at the site ended up developing upper and lower respiratory symptoms, which is highly suggestive of an inflammatory response to airborne toxins. Numerous Kingston workers have since developed an array of different health conditions that they attribute to their coal ash exposure, including respiratory and cardiovascular diseases, toxic neuropathies, and hematologic malignancies.

In my professional and scientific opinion, Jacobs failed to develop and implement an appropriate long-term, systematic plan for ensuring worker health and safety at the Kingston Site. Jacobs also failed to ensure that its personnel at the site were acting in an appropriate and responsible manner

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[3] TDEC Kingston Home. Ash Slide at TVA Kingston Fossil Plant. Department of Environment and Conservation. 2009 at https://archive.epa.gov/pesticides/region4/kingston/web/pdf/10644909.pdf.) *See also* "Survey of the Potential Environmental and Health Impacts in the Immediate Aftermath of the Coal Ash Spill in Kingston, Tennessee" by Ruhl and colleagues that was published in Environmental Science Technology in 2009. (Ruhl et al., 2009).

[4] Trial Tr., Volume IV, October 19, 2018, 553:5-554:14 (stating that Tom Bock told Michael Robinette to collect the dust mask being worn by a worker and the dust masks in storage and throw them all in a dumpster).

[5] *Id.* at 684:22-24 (stating that formal exit points "had a shed where they had places to be able to do that boot washing and also hand washing."); *id.* at 684:25-686:2 (stating that exit points had only boot wash pans and hand wipes).

[6] *Id.* at. 685:3-9.

[7] *Id.* at. 697:7-25 (admitting that there was only one shower on site and it would be unrealistic to expect more than five workers on a shift to go through only one shower); *id.* at. 684:24-685:2 (stating that none of the exclusion zone points of exit had showers).

[8] *Id.* at. 689:15-20 (stating that worker contamination from clothing in their vehicles and driving in an enclosed space was not taken into account by Mr. Bock, nor did Mr. Bock know of anyone who did); *id.* at. 691:2-10 (stating that the Site Wide Safety and Health Plan did not take into account workers traveling with fly ash on their clothes).

to carry out their contractual obligations to monitor and safeguard both its own workers as well as those of the various subcontractors working at the site. Despite the fact that Jacobs identifies itself as one of leading, if not the preeminent, engineering and construction contractors worldwide, it apparently had no mechanism in place to oversee the job performance of its safety personnel at the Kingston Site.

The consequence of Jacobs' lack of oversight was that the situation on the ground, evidenced through numerous photographs, worker testimony, and other materials and evidence, presented what should have been an obvious and unacceptable risk to an entity with the knowledge and experience of Jacobs', such that workers would be exposed to dangerous amounts of coal fly ash through inhalation and ingestion. Nonetheless, Jacobs failed to provide workers with adequate protection, denying them even basic respiratory protection and failing to monitor workers in any way for the high probability of exposure through ingestion. Jacobs' malfeasance extended even further into recklessness when its safety personnel on site made unscientific statements to the effect that a person could "eat a pound of coal ash per day and still be safe."[9] Of even more concern is credible evidence that Jacobs' safety personnel tampered with personal air monitoring equipment used at the site. In numerous ways, and as outlined further in this Report, Jacobs and its agents on site failed to adhere to the most basic industrial hygiene protocols, directly resulting in excessive exposures for the vast majority of the workers on site. Jacobs' failures allowed an environmental disaster to become an unnecessary occupational disaster.

## VII. Methodology:

The methodology used in this report is part of the industrial hygiene discipline termed retrospective exposure assessment (REA), recently defined as follows:[10]

> As part of the assessment and management of chemical risk and occupational hygiene, retrospective exposure assessment (REA) to chemical agents can be defined as the estimate of exposure associated with a person's work history . . .The REA approaches may vary from the use of methods based on a simple separation according to the category of work performed (e.g., dichotomization into "exposed" and "unexposed" workers) to more sophisticated assessments . . . Regardless of the strategy used, the common goal of retrospective exposure studies is to define an exposure estimate that is as accurate as possible, within the limits of the resources available.

In this case, since Jacobs had used the *prospective* approach of classifying site workers into similar exposure groups (SEGs), the REA approach used here *retrospectively* assesses Jacobs' industrial hygiene program. As part of this REA approach, I have reviewed the evidence produced in this case to analyze how Jacobs implemented its exposure assessments in each of its defined SEGs. All of the documents provided to the plaintiffs by Jacobs relative to their industrial hygiene program were evaluated, and all relevant industrial hygiene sampling results were extracted. The extracted

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[9] *Id.* at. 701:11-25 (stating Tom Bock told this or something similar to workers "in almost every sitewide orientation that [he] conducted . . . . between 2009 and 2010").

[10] Borghi, et al., "Retrospective exposure assessment methods used in occupational human health risk assessment: A systematic Review," Int J Env Res Pub Health 17:6190 (2020).

measurements and related industrial hygiene information were then organized into the Jacobs SEGs, and the adequacy of that collected data for attaining Jacobs' professed goals of evaluating worker exposure was assessed.

## VIII. Failures by Jacobs

As part of the remediation efforts at the Kingston Site, hundreds of people worked on, in, and among coal fly ash on a daily basis. Jacobs was contracted by the Tennessee Valley Authority to supervise these clean-up efforts. Part of that work included developing a plan to monitor and ensure worker safety on a site-wide basis. Jacobs was also tasked with enforcing the safety plan to ensure safety compliance by both its own employees as well as the employees of the various trades and subcontractors at the site.

At the outset, it is important to note that the dangers of exposure to coal fly ash are well-documented. In forming my opinions in this matter, I have relied on the opinions of Joseph Graziano, PhD and Norman Kleiman, PhD, two leading experts in the field of toxicology. They explain in great detail the many dangers associated with coal fly ash. I take, as a baseline, these dangers into account in forming my opinions.

However, Jacobs failed to develop a safety plan that would adequately protect the workers on the Kingston Site from excessive and dangerous levels of coal ash exposure. Jacobs either was entirely unaware of the dangers posed by exposure to coal ash, or Jacobs was recklessly indifferent to these dangers and refused to provide adequate protections for those working at the site. Either represents an abject, indefensible failure on the part of Jacobs to protect the workers.

Jacobs' deficiencies were compounded by its wholly inadequate implementation of the procedures contained within the safety plan it developed. Inadequate monitoring, inadequate reporting of results, intentional tampering with the monitoring equipment and manipulation of the results all point to reckless or intentional malfeasance. Moreover, Jacobs' lack of any effective corporate oversight of what was going on at the Kingston Site suggests strongly a systemic indifference to the plight of the workers, which Jacobs had the contractual and ethic responsibility to protect.

There are numerous examples of Jacobs' safety representatives at the Kingston Site telling workers that the coal fly ash was safe to be around and that exposure to it posed little or no danger to the workers' health.[11] For example, workers recall being told by Jacobs representatives that the coal ash posed so little danger that they could "eat a pound of coal ash a day," without suffering negative health effects.[12] It cannot be seriously disputed that Jacobs understood the dangers posed by human exposure to coal fly ash. It is a sophisticated, longstanding engineering and construction contractor

[11] Trial Tr. 701:11-25 (stating Tom Bock told this or something similar to workers "in almost every sitewide orientation that [he] conducted . . . . between 2009 and 2010"). Moreover, numerous plaintiffs recall supervisors at the Kingston site saying that the coal fly ash was "safe." For example, Mr. Farrow stated that a supervisor said the ash was so safe, "[y]ou could take a bath in it." Aug. 3, 2020 Farrow Depo., 72:20. Mr. Johnson recalled Tom Bock, a Jacobs employee, telling the workers at the site that they could "eat a pound of the fly ash and it wouldn't hurt [them]." Aug. 14, 2020 Johnson Depo., 36:20-21. Mr. Thompson likewise mentioned that Jacobs representative told workers that they could "eat a pound a day" of coal ash and it "won't hurt [them] a bit," which he believed because "they're safety" officials on the site. Sep. 6, 2017 Thompson Depo., 148:12-15.

[12] Aug. 14, 2020 Johnson Depo., 36:20-21; 51:7-8.

that has worked on dozens of governmental projects, many of which involved cleanup of hazardous waste site. The fact that it refused to provide adequate safety equipment to the workers, discouraging them from even requesting proper breathing protection while working day in and day out in fly ash at the site, while it simultaneously engaged in a misinformation campaign to downplay the dangers of coal ash illustrates how Jacobs knowingly sacrificed the safety of the workers at the Kingston Site.

Even assuming that Jacobs did not intentionally act in a detrimental fashion towards the workers—a conclusion that cannot be eliminated based on the evidence—it most assuredly failed to fulfill its duty to provide workers with adequate safety measures. These failures directly exposed the workers to the dangers of high-intensity exposure through inhalation, ingestion, and/or dermal contact with coal fly ash described in more detail by the other experts in this litigation. These failures to provide adequate protection, coupled with the dangerous conditions on the Kingston Site, represent clear violations of standard, common-sense industrial hygiene protocols.

Examples of such failures are numerous, but they can be divided into distinct categories, each of which alone represents compelling evidence of Jacobs' failure to adhere to reasonable industrial hygiene standards. However, when analyzed in concert—as they must be—they illustrate an almost incomprehensible failure by a sophisticated, experienced governmental contractor that directly and unnecessarily increased each worker's exposure to coal fly ash. These categories include:

- Lack of adequate protective equipment provided to the workers;
- Lack of facilities and/or areas on the site that were free of coal ash;
- Lack of proper facilities to clean themselves; and
- Failure to use proper monitoring methods.

I will discuss each of these categories separately. However, none of these categories should be analyzed in a vacuum, as none of these failures existed to the exclusion of any other. Further, Jacobs' failures are multifaceted, and each of these categories contains sub-categories that deserve discussion and analysis.

### A. *Jacobs failed to ensure the workers at the Kingston Site had access to proper protective equipment to adequately safeguard them from the dangers associated with coal ash exposure.*

Almost all the plaintiffs in this matter stated that they did not wear respiratory protection while working at the Kingston Site because Jacobs did not ensure the availability masks or respirators to them.[13] Further, many of the plaintiffs stated that Jacobs, through its safety personnel

[13] Many plaintiffs explained that they did not wear masks while working on the site, that masks were not provided, and that they would be punished if they asked for or actually wore a mask on the site. For example, Mr. Thompson testified that Jacobs representatives removed all the masks that were stored on the Kingston site, and "wouldn't let [the workers] have them." Sep. 6, 2017 Thompson Depo., 146:3-6; 146:11-13. Mr. Thompson also recalled Chris Eich, a Jacobs employee, very explicitly tell him that he would be "hung" if he wore a dust mask on the site. Sep. 6, 2017 Thompson Depo., 145: 23-24. Mr. Gibson recalled asking Chris Eich, if he could wear a mask, and Mr. Eich

representatives on the site, repeatedly told workers that the coal fly ash was safe to work in, to be around, and even to eat. Regardless of whether these statements were made to the workers out of total misunderstanding of the dangers of coal ash—which in itself is as inexcusable as it is unbelievable—or out of an intentional misinformation campaign directed to the workers regarding the dangers of coal ash exposure is immaterial to my opinion. Regardless of its motivation, Jacobs failed in its duty to ensure the availability of masks and/or respirators to all workers at the Kingston site.[14]

Even more troubling is the fact Jacobs allowed a work climate to exist where the workers at the Kingston Site knew that masks were *not allowed* to be worn on the site, and that if they requested respiratory protection or were seen wearing it, they would be punished or dismissed.[15] In allowing the existence of this work environment, Jacobs failed in its primary industrial hygiene responsibility of providing planning and supervision of the site to ensure a safe workplace. Numerous workers recalled hearing Jacobs' safety personnel Tom Bock or Chris Eich telling workers that they would be punished if they wore a mask or respirator on the site.[16] Some workers understood that Jacobs was concerned that, should workers wear visible respiratory protection at the site, the public would grow concerned that the ash spill was more dangerous or harmful than they had been led to believe.[17] In short, Jacobs appeared more concerned about the public's perception of danger (something it had no contractual obligation to provide) than about protecting against the actual dangers of coal fly ash exposure that the workers under its supervision faced on a daily basis (a core responsibility under its contract with the Tennessee Valley Authority).

Wearing a respirator would have substantially reduced a worker's exposure to hazardous airborne contaminants, and the SWHSP, which is discussed in detail below, stated that "workers may voluntarily use a respirator with the approval of their supervisor." However, as noted, worker testimony and extensive documents demonstrate that proper respiratory protection was not provided to the site workers, and was actively discouraged. Mr. Bock, the Jacobs EHS leader, even testified that "[he] [didn't] know if there were NIODH-approved respirators kept on site for workers."[18] It is extremely problematic that Jacobs' EHS leader at the site could admit that he was unaware whether they kept respiratory protective equipment on hand at a site where airborne fly ash was prevalent. This represents an egregious failure to abide by industrial hygiene protocols.

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told him that he "could not wear" a mask, in part because the "public would see [the workers] wearing [the masks]." Gibson Interrogatory Responses; April 10, 2017 Gibson Depo., 101:9-10.

[14] A few plaintiffs did recall having access to masks or respirators for certain job duties while at the site. For example, Mr. Church stated that he wore a mask and face shield while vacuuming coal ash out of trucks and other equipment. April 19, 2017 Church Depo. 41:24-42:1. However, he explained that the mask "did not help protect [him] from coal ash." Church Interrogatory Responses .The vast majority or workers, though, stated they were either denied respiratory protection outright, or were actively discouraged from requesting it.

[15] Multiple workers appear to have been threatened. For example, at least five plaintiffs recalled that Mr. Thompson was fired for requesting to wear a mask at the Kingston site. *E.g.*, Sep. 25, 2017 Berry Depo., 115:8-17.

[16] *E.g.*, Sep. 6, 2017 Thompson Depo., 145: 23-24; Feb. 10, 2017 McCarthy Depo., 91:13-23.

[17] For example, Mr. Gibson recalled asking Chris Eich, if he could wear a mask, and Mr. Eich told him that he "could not wear" a mask, in part because the "public would see [the workers] wearing [the masks]." Gibson Interrogatory Responses; April 10, 2017 Gibson Depo., 101:9-10.

[18] Doc. No. 414 – K. Thompson, Robinette, Brewer, Bock-117, p. 758.

Given the documented dangers of coal ash, the proper industrial hygiene protocols would include providing personal protective equipment to all workers working on the Kingston Site, including providing them with proper respiratory protection. Jacobs should have accurately and truthfully informed the workers about the potential dangers related to coal fly ash exposure. Instead, Jacobs did neither. It refused to acknowledge the dangers of coal ash, but instead actively downplayed the dangers relating to coal ash exposure. Further, it refused to provide proper respiratory to the workers, and instead actively discouraged workers from wearing proper respiratory protection, which harbored the belief among the workers on the site that they would be fired if they did wear, or even asked to wear, respiratory protection. These actions constitute either an incomprehensible ignorance about the dangers of exposure to coal fly ash and how to protect workers against them, or a reckless or intentional disregard of these dangers and their consequences. In either case, the result of Jacobs' failure to provide adequate industrial hygiene measures was an unnecessarily increased risk that the workers would become exposed to the toxic effects of coal fly ash through exposure via inhalation.

### B. *Jacobs failed to ensure the workers at the Kingston Site adequate facilities and/or areas free of coal fly ash where workers could safely take breaks or eat meals.*

Many workers report that the coal ash was "everywhere" on the Kingston Site,[19] and the coal fly ash often seemed inescapable.[20] They explained that, although there were designated break areas on the site, these areas were often, if not always, "covered in ash."[21] Some reported that they could "taste" the coal ash in the air because it was so prevalent throughout the site, both on the ground and in the air. They described it as a metallic taste,[22] stating that it felt "gritty" in their mouths.[23] Others explained that coal ash regularly settled on their food, even while eating it in the designated locations.[24] Others similarly reported that coal ash would get into their drinks, or into the container holding their drinks.[25]

[19] Mr. Booker stated that "[e]verything was covered in coal ash on the site including where [he] ate [his] meals." Booker Interrogatory Responses. Mr. Church noted that there was so much ash in the environment at Kingston that it "coated everything." Church Interrogatory Responses. Mr. Kilby stated that "[t]he Kingston site and everything on it was always covered in coal ash. It got onto all the machines, buildings, and people. There was so much ash in the air that it looked like a dust cloud." Kilby Interrogatory Responses. Mr. Clark stated that "[c]oal ash was everywhere like a blue haze hanging over the clean-up site." Clark Interrogatory Responses.

[20] Mr. Kilby stated that "[t]here was no escaping [the coal ash]." Kilby Interrogatory Responses.

[21] Mr. Church stated that "[they] had a building where [they] could take breaks and eat lunch, but it was full of ash . . ." Church Interrogatory Responses.

[22] For example, Mr. Clark stated that "[y]ou could taste the coal ash" and described it as having "a strong metallic taste." Clark Interrogatory Responses.

[23] Kilby Interrogatory Responses (stating that "[he] could taste the ash in [his] mouth. It was gritty like sand.").

[24] For example, Mr. Church stated that "[he] could taste coal ash and it always ended up in your food and drinking water." Church Interrogatory Responses.

[25] Mr. Watkins stated that "[t]here was always coal ash in my food and on my water bottles no matter where I tried to eat." Watkins Interrogatory Responses. Mr. Bledsoe stated that "[t]he ash got on [his] food and drinks." Bledsoe Interrogatory Responses.

Such industrial hygiene practices have been widely known in industrial hygiene for the last one-hundred years.[26] The lack of such facilities at the Kingston site was confirmed not only by overwhelming worker testimony, but also by EPA and Tom Bock, the Jacobs EHS leader.

For example, in Mr. Bock's trial testimony[27] he was asked the following regarding an EPA site audit in 2009:

> Q: And then the next part deals with personnel. And that's what I want to ask you about. It says "No formal personnel decontamination lines are set up. There are boot wash areas at entry points for the exclusion zone with water tubs and brushes to remove ash from boots. There are no facilities for showering, nor are there any change rooms provided for removal of soiled or contaminated clothing" Did I read that correctly?
>
> A: yes, sir.
>
> …
>
> Q: Did Jacobs ever put in any kind of mechanism for workers to get showers before leaving the site?
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> A: There were showers that were established, I believe, per this – a response to this for gross decontamination. There were showers available at the medic trailer.
>
> Q: Were the workers required to shower before they left the site?
>
> A: No, sir
>
> Q: Were workers given a place where they could change clothes to get their clothes with fly ash off their bodies?
>
> A: Yes, sir.
>
> Q: Where was that?
>
> A: Their break rooms and the locations where they would end the day.

A single shower location at the medical trailer and changing clothes in a break room do not constitute proper industrial hygiene practice.

The absence of proper facilities to remove fly ash contamination from the clothing and skin certainly caused increased worker exposure by two routes: inhalation from dried dust that is resuspended whenever contaminated skin or clothing is contacted, and ingestion, from hand-to-mouth transfer during eating, etc.

This is obviously problematic and unacceptable from an industrial hygiene standpoint. Jacobs should have either designated safe areas far enough away from the active work areas to ensure that exposure to coal fly ash would be prevented while the workers took breaks or ate their lunches, or

[26] See e.g. Erskine & Roach, "The standardization of working essentials," Ann Am Acad Pol Soc Sci 71:82-95 (1917).
[27] Doc. No. 414 – K. Thompson, Robinette, Brewer, Bock-117, p. 681.

it should have taken additional steps to ensure the fly ash was regularly and systematically removed from the break areas it did designate. Jacobs' failure in this respect represents improper dereliction of its industrial hygiene duties generally, as well failure to comply with the requirements under its contract with the Tennessee Valley Authority. Jacobs' failures unnecessarily increased the risk that the workers would become exposed to coal fly ash through inhalation and/or ingestion.

### C. *Jacobs failed to ensure the workers at the Kingston Site had access to proper facilities where workers could adequately clean themselves or their equipment of excess fly ash.*

Virtually all workers explained that the Kingston Site lacked adequate facilities for cleaning the coal ash off their persons, their clothing, their belongings, and their personal and vehicular equipment.[28] Numerous workers recalled boot washing stations, but nearly all those workers explained that the boot washes were ineffective.[29] In fact, some described that the boot wash would simply collect murky coal ash slurry, which would more often than not cause a worker's boot to become more fouled with fly ash, rather than removing any of it.[30] Many individuals reported that there were no showers or wash areas on the Kingston site where they could remove excess coal ash from their bodies.[31] Further, there were no facilities where excess coal ash could be removed from a worker's clothing or, where they could change out of their ash-covered clothing before leaving the Kingston Site. Some plaintiffs recalled that they were forced to clean coal ash off themselves with towelettes or baby wipes, which proved to be ineffective.[32]

This absence of adequate cleaning facilities also implicates the previous problem. For example, without adequate boot washing stations or areas where workers could remove ash from their clothing or clean themselves, it was inescapable that a fine particulate such as fly ash would enter designated "clean" zones, through no fault of the workers.[33] Jacobs' adherence to proper industrial hygiene protocols by ensuring access to adequate cleaning facilities for workers to wash and clean themselves would have mitigated or prevented the risk of high-intensity exposure to the coal fly ash at the Kingston Site.

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[28] Mr. Cunningham testified that "we didn't have nothing to wash off with except a water hose if we – if you wanted to wash off with it, which it come out of the lake, and that's where the ash went to." Aug. 14, 2020 Cunningham Depo., 174:9-13. Mr. Watkins stated that "[a]t the end of the shifts, we did not have anywhere to get cleaned off. [His] personal truck was coated in coal ash, and [he] had no way to clean it out."

[29] Mr. Clark stated that "[t]he boot wash was just a plastic pan of water with a brush. There wasn't running water and they did not change out the water in the boot wash. After one or two people used the boot wash, the whole pan was full of muddy coal ash." Clark Interrogatory Responses. Mr. Watkins explained that "[b]y the time 3 people used the boot wash, you would just be slopping your boots in pure coal ash because there was no way to change the water." Watkins Interrogatory Responses.

[30] Watkins Interrogatory Responses ("By the time 3 people used the boot wash, you would just be slopping your boots in pure coal ash because there was no way to change the water.").

[31] Mr. Church stated that "there was nowhere to wash off with water before you ate lunch or used the bathroom." Church Interrogatory Responses.

[32] Mr. Bledsoe recalled that "[a]fter [he] ate lunch, there was no way to wash [his] hands at first. They eventually provided us with baby wipes, but they did not work well enough to remove the ash." Bledsoe Interrogatory Responses.

[33] For example, Mr. Church stated that "[they] had a building where [they] could take breaks and eat lunch, but it was full of ash because people would track it inside and onto the floor and surfaces." Church Interrogatory Responses.

Many individuals, particularly those who worked as truck drivers and heavy equipment operators on the Kingston Site explained that the fly ash regularly got inside their cabs.[34] Many described how the ash, once it had entered the vehicle interior, could be seen floating around in the air or settling on the surfaces inside the cab.[35] Some describe how the coal ash would settle in a thick "film," and that it could cover their windshields, windows, and gauges,[36] which itself presented a danger. Some recalled that they would have to constantly wipe off the ash with their hands in order to see gauges, or to see out the windshield while driving.[37]

Coal fly ash infiltrating into the vehicle interior poses a serious risk of increasing a worker's exposure to dangerous levels. A vehicle operator is in an enclosed space surrounded by fly ash circulating in the air, increasing the duration of high-intensity exposure which violates proper industrial hygiene protocols. While Jacobs established a procedure for vacuuming out trucks and heavy equipment during the night, that process alone was insufficient to protect workers. Numerous accounts illustrate how fly coal ash collected in thick films and could be seen floating inside the cab during work shifts, despite the previous evening's attempt at cleaning. This fact also makes it apparent that adequate industrial hygiene procedures required Jacobs to provide access to proper respiratory protection for all workers, including those working in enclosed cab environments.

Jacobs' failure to provide adequate facilities where workers could remove coal ash from their clothes or could shower and change clothes, or its failure to provide such facilities in sufficient number, forced many workers to leave the Kingston site still covered in coal ash. This, in turn, allowed the coal fly ash to escape the site on the workers' clothing, depositing ash in the workers' personal vehicles and their homes. Many plaintiffs explained that, when they returned home after working at the site, they could see the coal ash on their clothing.[38] Some recalled removing their clothes to take showers, during which they would see the coal ash wash away from their skin. Because of Jacobs' failure to adhere to proper industrial hygiene standards, workers lacked an ability to regularly and thoroughly rid themselves, their clothing and their personal vehicles from the coal fly ash they accumulated during working hours, thereby prolonging their exposures. This failure also increased the risk that fly ash escaped the work site, thereby exposing workers' families and the general public to unnecessary and avoidable exposures.

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[34] Mr. Kilby explained that "[his] equipment was always covered in a film of coal ash. The ash got inside the cab through the windows, open doors, and the air vents. Every time [he] walked around the site and got back into the equipment, coal ash fell off [his] boots and clothes onto everything. The floorboards were covered. It was all over the seats, dashboard, and windshield." Kilby Interrogatory Responses.

[35] Mr. Summers stated that "[t]he outside and the inside of the trucks that [he] drove were filled with ash. The ash got all on the floorboards from [his] boots but also all over everything else in the cab because it floated in and settled all over." Summers Interrogatory Responses.

[36] Mr. Williams recalled that "[t]he ash inside my truck covered everything including the dash, windshield, seats, and steering wheel. [He] had to constantly wipe the cab down because it got so dusty. It was difficult to see inside the cab because there was always a film on the window and the dashboard no matter how much [he] cleaned it." Williams Interrogatory Responses. Mr. Thacker stated that "[t]he ash covered [his] equipment. It would cover the outside and the inside of the cab. The ash got into the cab through the window and vents because it was so thick in the air, but so much ash fell off my boots and clothes that there was a film of ash in the cab. It was on the floor, seats, dashboard, and windshield." Thacker Interrogatory Responses.

[37] Mr. Summers stated that "[the ash] was on the steering wheel, seats, dashboard, and windshield. [He] had to wipe it off constantly. However, it got dirty again quickly." Summers Interrogatory Responses.

[38] Mr. Jones stated that "[he] could see the ash particles all over [his] clothes." Jones Interrogatory Responses.

The absence of proper washing, showering and changing facilities increased the workers' risk of exposure through inhalation, ingestion, and/or dermal contact. It also exposed workers' families and the public at large to fly ash that escaped the work site through no fault of the workers. These failures to establish adequate facilities for workers to clean themselves, their clothing, and their belongings represent Jacobs' indisputable dereliction of its duty to adhere to basic industrial hygiene principles, to its contractual obligations to the Tennessee Valley Authority, or to its moral and professional responsibilities to the workers at the Kingston Site.

### D. *Jacobs failed to employ proper monitoring methods, which could accurately assess the workers' total body burden relating to coal ash.*

Jacobs' most egregious failure relates to its responsibilities to provide a robust, valid method of industrial hygiene monitoring at the Kingston Site. Industrial hygiene (IH) sampling was performed by EnSafe from December 30, 2008 through June 30, 2010, and by Jacobs from July 1, 2010 until June 10, 2014, the last date when sampling results were found in the database.

The IH testing performed at the Kingston Site is far too inconsistent and infrequent to properly determine what the workers were exposed to. Specific shortcomings include the fact that the procedure followed in developing the IH sampling plan, in particular the selection of similar exposure groups (SEGs) to be monitored, was haphazard at best. No rationale was found for any of the actual SEGs used. There were a multitude of samples which were excluded or voided for no discernible reason. Furthermore, there are various indicators of manipulation of sampling data and tampering with the actual samples themselves. This is demonstrated through a thorough review of the revisions to the Site Wide Safety and Health Plan (SWSHP), the IH sampling results, and an overwhelming amount of consistent worker testimony.

Moreover, the multiple methods of sampling and testing used were improper. Far more effective sampling methods were available, and should have been used, which I discuss below. In short, Jacobs' methods of collecting data from the workers on the Kingston site were ineffective given the prevalence of coal ash; and there is overwhelming, consistent evidence that Jacobs tampered with the sampling or otherwise manipulated the testing results, such that, from top to bottom, the sampling and testing methodologies used are entirely unreliable. Moreover, as discussed below in Section XIII.A., biological monitoring should have been employed here. Jacobs' refusal to employ appropriate sampling and monitoring methods represents serious, abject failures from an industrial hygiene standpoint.

## IX. Method of Industrial Hygiene Sampling Plan

EnSafe and Jacobs adopted the IH sampling approach of defining SEGs consisting of workers that, in their judgement, would have similar exposures. This was done so that samples collected from a few workers would be representative of the entire SEG. There is no discussion of SEGs in the

initial Site Wide Safety and Health Plan (SWSHP) dated April 2, 2009,[39] while Revision 3 dated June 2009 lists ten "Processes or Tasks" in Appendix B.[40]

In the Site Wide Safety and Health Plan (Revision 4), dated February 2010, Section 5.1.1.1, titled "Exposure Group Evaluation," Jacobs states:

> An evaluation of all tasks will be performed to determine recognized exposure groups within each activity. Once this has been done, a review of existing data from samples already collected will be evaluated and if possible correlated to exposure groups identified for each task. If data gaps exist, additional monitoring will be performed until all exposure groups have been adequately characterized until at least a 95 percentile confidence interval has been achieved.

Continuing in Section 5.1.1.2, "Routine Monitoring," Jacobs makes the following statements:

> Once all exposure groups are adequately characterized, routine monitoring will be performed on those groups perceived to be at highest risk based on collected data. Typically this will include the following in order of highest priority:
>
> - Exposure groups showing results higher than established action levels (50% of the PEL), but less than the PEL
> - Exposure groups showing results greater than the established permissible exposure limits
> - Exposure groups routinely working in areas with highest total dust concentrations independent of chemical specific results
> - Exposure groups working in direct proximity to any of the above groups
>
> Routine monitoring will be performed until statistical significance to at least 95th percentile has been established for all groups and all data is properly validated.

In their July 2010 Progress Report,[41] Jacobs stated that "as discussed in the Industrial Hygiene Monitoring Plan, Jacobs has divided the working crews into 34 SEGs." The statements made in Revision 4 are repeated, verbatim, in Revision 5, dated October 2010,[42] four months after routine IH measurements started. In addition, Revision 5 presents the same list of ten "Processes or Tasks" in Appendix B,[43] as they appeared in Revision 3. Thus, the Site Wide Safety and Health Plan dated October 2010 does not discuss the establishment of the 34 SEGs claimed in the July 2010 Progress Report.

Appendix B of Revision 6,[44] dated January 2013, reduced the list of processes or tasks to be monitored from ten to eight, but for the first time includes in Appendix K[45] Table 2-1, a list of "Similar Exposure Groups Identified at Kingston Ash Recovery Project Site (with activity/task

[39] Trial Exhibit 2.
[40] Trial Exhibit 3-d.
[41] JEGS 0071481 – IH 2010, p. 2.
[42] Trial Exhibit 5-b.
[43] Trial Exhibit 5-e.
[44] Trial Exhibit 6-e.
[45] Trial Exhibit 6-j.

subsets)." This table, attached here as Exhibit D, lists 14 SEGs and 63 activity/task subsets. Some SEGs have no activity/task subsets while one (on-Land Operator) has 15.

Revision 7 of the Plan, dated January 2014, in Section 5,[46] repeats the exact same language regarding "Exposure Group Evaluation" and "Routine Monitoring' as quoted above from Revision 4 dated, February 2010. Thus, the plan still states that SEGs will be created, but does not describe the actual process that was followed to establish them.

Section 2.0, "Industrial Hygiene Process Overview," Section 2.1, "Identify Similar Exposure Groups"[47] states:

> The collaboration of TVA Safety and IH staff, EnSafe, and Jacobs have established SEGs for differing categories of employees with potentially or expected similar exposures from work conducted at the Kingston Ash Recovery Project site. Segregation into SEGs is a function primarily of equipment-specific positional assignments or site responsibilities...
>
> Table 2-1 contains a listing of SEGs presently identified for the Kingston Ash Recovery Project operations. As activities change or are added to the site, additional exposure groups may be added as necessary.
>
> Table 2-1 of Revision 7 is identical to Table 2-1 of Revision 6.

Although not stated explicitly in the SWHSP, the data indicate that EnSafe and Jacobs decided to collect four types of samples, i.e., total particle mass (TPM), respirable particle mass (RPM), silica (Si), and toxic metals.

Based on the July 2010 Progress Report, the number of SEGs used by EnSafe apparently was 34. However, at some undefined time between July 2010 and January 2013, Jacobs redefined the SEGs, either reducing them to 14 or expanding them to 63, depending on whether each "activity/task" listed in Table 2-1 is considered a separate SEG.

EnSafe and Jacobs should have provided a description of the specific reasoning used for the development of each SEG and activity/task. Without such a description, I can only conclude that each SEG and activity/task was selected arbitrarily, and I can have no confidence that all of the workers in any SEG or activity/task actually had similar exposures to airborne contaminants. Just based on the group names included in Table 2-1, it is difficult to conclude that the same decision process was used across all of them. Examples of apparent inconsistencies and lack of clarity include:

1. Some of the activity/task subsets appear to be identical – e.g., "Heavy Equipment mechanic" and "Equipment Mechanic, Heavy".
2. Some of the SEGs names are vague and seem to be very broad – e.g., "Southern Shores". What is a "Southern Shore" worker, and why would all such workers have the same exposure?
3. The activity/tasks listed under "Perimeter Wall Crew" have identical titles as other tasks, except they include "BP_" or "SW_". What does this mean, and why does a

[46] Trial Exhibit 7-b.

[47] Trial Exhibit 7-j.

“”BP_Forklift Operator”, e.g., have a different exposure profile from a “Forklift Operator”?

In addition, no reasons could be found for the decision to monitor TPM, RPM, Si and metals. In particular, some thought should have been given to the choice to monitor both TPM and RPM, especially in light of the actual sampling that was performed, discussed below, where it is evident that TPM and RPM samples were both collected in a seeming random fashion. Total particle mass (also called inhalable mass by industrial hygienists) sampling (TPS), measures the airborne concentration of particles that deposit throughout the respiratory tract, while respirable particle sampling (RPS) measures the airborne concentration of particles that deposit in the alveolar region of the lungs. No reasons were found for the decisions made as to when to perform TPM sampling and when to perform RPM sampling.

Specific sampling was never performed for silica and metals; rather, some TPM and RPM samples were selected for further analysis for silica or metals. Typically, RPM samples were analyzed for Si, and TPM samples were analyzed for metals. This seems appropriate, since silica attacks the alveoli and toxic metals can leach out of particles that deposit anywhere in the respiratory system. This practice was not always followed, however, as discussed below. In addition, no reasons could be found for the decisions to select particular samples for further analysis.

## X. Industrial Hygiene Sampling Results

There is no evidence in the documents reviewed that biological monitoring was ever performed on any worker at the Kingston Site, which is more fully discussed in Section XIII.A. below.

The only IH samples obtained were through the use of personal air monitors. These sampling results are examined below.

The total number of samples collected, by year and SEG/activity/task, is shown in **Table 1**.

| SEG | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | Total |
|---|---|---|---|---|---|---|---|---|
| Site-Wide Staff Support | 1 | 14 | 5 | 55 | 18 | 014 | 5 | 112 |
| Field Staff | | | 2 | 27 | 4 | 11 | 5 | 49 |
| Mgmnt/Admin | | 5 | | 1 | | | | 6 |
| Misc. | | | | | | | | 0 |
| Sample Technician | | | 3 | 27 | 14 | 3 | | 47 |
| Security | 1 | 9 | | | | | | 10 |
| | | | | | | | | |
| On-Land Operation | 10 | 118 | 52 | 108 | 21 | 14 | 5 | 309 |
| Amphib Excavator Operator | 6 | 63 | 9 | 9 | 1 | | | 88 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Booster Pump Operator | | | | 2 | | | | 2 |
| Buggy Operator | | 2 | | | | | | 2 |
| Clam Bucket Operator | | | | | | | | 0 |
| Crane Operator | | | | 2 | | | | 2 |
| Dozer Operator | 2 | 45 | 13 | 34 | 6 | 3 | | 103 |
| Excavator Operator | | 3 | 4 | 34 | 9 | 6 | 2 | 58 |
| Forklift Operator | | | | 2 | | | | 2 |
| Fuel Truck Operator | | | | 10 | | | | 10 |
| Grader Operator | 2 | 5 | 3 | 1 | | 3 | 2 | 16 |
| Lime Application/Mixing | | | | | | | | 0 |
| Pump Operator | | | | | | | | 0 |
| Scraper Pan Operator | | | 23 | 14 | 5 | 2 | 1 | 45 |
| Shoreline Operator (river ops) | | | | | | | | 0 |
| Track Dump Operator | | | | | | | | 0 |
| | | | | | | | | |
| Drill Crew | | 2 | 2 | 12 | 26 | 13 | | 55 |
| | | | | | | | | |
| Hydroseed Crew | | | 6 | | 7 | 15 | 4 | 32 |
| | | | | | | | | |
| Southern Shores | | | | | | | | 0 |
| | | | | | | | | |
| On Water Operator | 0 | 8 | 1 | 0 | 0 | 0 | 0 | 9 |
| Boat Operator | | 4 | | | | | | 4 |
| Dredge Boat Operator | | 2 | 1 | | | | | 3 |
| Dredge Shore Operator | | | | | | | | 0 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Tugboat Operator | | | | | | | | 0 |
| Vacuum Barge Operator | | 2 | | | | | | 2 |
| | | | | | | | | |
| On-Water Laborer | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 5 |
| Boat Laborer | | 1 | 2 | | | | | 3 |
| Deck Hand | | 2 | | | | | | 2 |
| Dredge Laborer | | | | | | | | 0 |
| Fuel Boat Crew | | | | | | | | 0 |
| | | | | | | | | |
| Mechanic | 0 | 0 | 11 | 10 | 7 | 10 | 6 | 44 |
| Heavy Equipment Mechanic | | | 11 | 10 | 7 | 10 | 6 | 44 |
| Equipment Mechanic, Heavy | | | | | | | | 0 |
| Equipment Mechanic, Heavy | | | | | | | | 0 |
| | | | | | | | | |
| Filter Press Operations | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 3 |
| Filter Press | | | | | | | | 0 |
| Filter Press Foreman | | | | | | | | 0 |
| Filter Press Operator | | | 3 | | | | | 3 |
| | | | | | | | | |
| Perimeter Wall Crew | 0 | 0 | 0 | 39 | 90 | 0 | 0 | 129 |
| BP_Forklift Operator | | | | 3 | 16 | 2 | | 21 |
| BP_Gen Laborer | | | | 4 | 13 | 4 | | 21 |
| BP_Mixing Crew | | | | 32 | 61 | 14 | | 107 |
| SW_Dozer Ops | | | | | | | | 0 |
| SW_Excavator | | | | | | | | 0 |
| SW_Gen Laborer | | | | | | | | 0 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Teamster | 6 | 57 | 26 | 58 | 17 | 6 | 6 | 179 |
| Artic Dump Truck Operator | 5 | 36 | 13 | 30 | 9 | 2 | 4 | 99 |
| Dump Truck Operator | | 17 | 2 | 8 | 1 | | | 28 |
| Fuel Truck Driver | | | | | 1 | | | 1 |
| Vacuum Truck Operator | | 3 | | 1 | 1 | | | 5 |
| Water Truck Operator | 1 | 1 | 11 | 19 | 5 | 7 | 2 | 46 |
| | | | | | | | | |
| Railcar Loadout Laborer | 0 | 0 | 47 | 5 | 0 | 4 | 4 | 60 |
| Loadout Laborer (Railcar) | | | 11 | 5 | | | | 16 |
| Polymer | | | | | | | | 0 |
| Railcar Loading - Closer | | | 24 | | | | | 24 |
| Railcar Loading - Liner | | | 12 | | | 4 | 4 | 20 |
| | | | | | | | | |
| Railcar Loadout Operator | 0 | 1 | 20 | 0 | 0 | 0 | 0 | 21 |
| Railcar Loading - Dozer | | 1 | 10 | | | | | 11 |
| Railcar Loading - excavator | | | 10 | | | | | 10 |
| | | | | | | | | |
| On-Land Laborer | 1 | 82 | 17 | 84 | 11 | 13 | 5 | 213 |
| Decon Laborer | | | 2 | 14 | | | | 16 |
| Decon Laborer (vacuum) | | | 2 | | | | | 2 |
| Equipment Decon Detail | | | | | | | | 0 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Flagger | 1 | 40 | 8 | 47 | 7 | | | 103 |
| General Laborers | | 36 | 4 | 14 | 4 | 13 | 5 | 76 |
| Rail Maintenance Laborer | | | | | | | | 0 |
| River Ops - Shore Laborer | | 6 | 1 | 9 | | | | 16 |
| Water Truck Laborer | | | | | | | | 0 |
| | | | | | | | | |
| **Yearly Total** | **18** | **285** | **205** | **384** | **197** | **109** | **47** | **1261** |
| | | | | | | | | |
| **Voided samples** | | **23** | **9** | **10** | | **12** | **5** | **59** |
| | | | | | | | | |
| **Valid samples** | **18** | **262** | **196** | **374** | **197** | **97** | **42** | **1202** |

**Table 1. Number of samples collected, by year and SEG/activity/task.**

Eighteen samples were collected in 2008, all on 30 December, immediately after the spill.

Sampling began in earnest in 2009. As shown in **Table 1**, 285 samples were collected in 2009, although almost 10% (23) were invalidated because of sampling errors such as pump failure. Samples were collected in 8 out of 14 SEGs and 20 out of 63 activity/tasks.

These numbers indicate the tremendous inadequacies of the sampling that was performed in the time period immediately after the coal ash spill, presumably when exposures were highest and when the effort was being made to establish SEGs. Six of 14 SEGs had *no* samples collected in this first year, and more than two/thirds (43 out of 63) of the activity/tasks also had *no* samples collected. Of the 20 activity/tasks that had sampling performed, 12 of them had fewer than 5 samples collected, with 3 having only 1 sample collected the entire year. A total of 261 valid samples, divided evenly among the 63 activity/tasks, gives an average number of samples collected per task of 4.1. With such few samples collected, it is impossible to determine "statistical significance to at least 95th percentile," the stated goal of the SWSHP. Thus, by its own metric established in the SWSHP, Jacobs has failed to abide by its self-established industrial hygiene protocols for sampling. This is discussed further below.

The first year after the accident (2009, plus 31 Dec 2008) was the time when EnSafe had the most urgency to determine representative airborne exposure concentrations for all of the SEGs, in order to ascertain which groups of workers were at greatest risk from overexposure. EnSafe failed miserably at this task; only 8 out of 63 activities had 5 or more samples collected, there is no way that a representative exposure level for the other 55 activities could be determined during this crucial time period.

Seemingly random and scattershot sampling continued into 2010, when a total of only 205 samples were collected. They were distributed among 26 activity/tasks, still only 43% of the total. Exactly half, 13, had fewer than 5 samples collected, and the average number of samples collected per activity was 3.0. We can expand the analysis of the last paragraph to include the first two years after the accident (2009, 2010, 30 December 2008); during this crucial two-year period, only 18 out of 63 activities (29%) had a total of at least 5 samples collected. Thus, at the end of two years of cleanup work, 45/63 activities (71%) had had insufficient sampling to even begin to characterize typical exposures. In fact, 32/63 (51%) had had exactly ZERO samples collected over the first two years.

Air sampling reached its peak in 2011, when 384 samples were collected but again in only 26 activity/tasks. The number of activity/tasks that had ever been sampled over the first three years climbed to 40 out of 63, meaning that more than one-third of the activity/tasks had had no samples collected over the first three years.

Air sampling decreased in 2012, with only 197 samples collected in only 19 activity/tasks. One new activity/task was sampled in 2012 (a single sample for a fuel truck driver, the only sample in this activity/task over the entire seven-year period), meaning that 21 out of 63 activity/tasks (exactly 1/3) remained unsampled after four years.

Air sampling continued to decline in 2013 and 2014, with only 109 and 47 samples collected, respectively. No previously-unsampled activity/tasks were added in 2013 or 2014.

Over the entire six-year sampling period, one-third of the SEG/activity/tasks identified by Jacobs as requiring sampling to determine with 95% confidence the typical exposure levels had exactly ZERO worker samples collected. Of the 42 SEG/activity/tasks where sampling did occur, over the six years, one had 1 sample, five had 2 samples, three had 3 samples, and one each had 4, 5, or 6 samples. Thus, 33 out of 63 SEG/activity/tasks had 6 or fewer samples collected over the entire six-year sampling period, for an average of 1 sample/year or less. Based on the lack of sampling, for the vast majority of activity/tasks it is impossible to calculate representative airborne exposures with the 95% confidence specified in the SWSHP.

### A. Industrial Hygiene Samples per Year

The following tables show the number of samples collected in each year, broken out by specific contaminant.

Sampling was performed on one day, December 30, in 2008. Eighteen air samples were collected from seven activity/tasks in four SEGs, all but one for metals, as shown in **Table 2** below.

| SEG/Actvity & Task | Contaminant measured | | | | Notes |
|---|---|---|---|---|---|
| | Total Particles | Respirable Particles | Silica | Metals | |
| Site-Wide Support | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Security | | | | 1 | |
| On-Land Op | | | | | |
| Amphib Excav Op | | | | 6 | |
| Dozer Op | | | | 2 | |
| Grader Op | | | | 2 | |
| Teamster | | | | | |
| Artic Dump Trk Op | 5 | | | | |
| Water Truck Op | | | | 1 | "Truck Operator" |
| On-Land Laborer | | | | | |
| Flagger | | | | 1 | |
| **Totals** | **5** | **0** | **0** | **13** | |

**Table 2. Samples collected in 2008.**

Samples collected in 2009 are summarized in **Table 3** below. There is no obvious rationale behind the selection of samples that were collected. The vast majority of samples were collected in only 5 out of the 60 activity/tasks, but the reasoning behind this decision is not known. The result, of course, is that very little was learned about the actual exposures in the other 58 activity/tasks.

Approximately equal numbers of samples for total particles and respirable particles were collected, with no apparent rationale for why this was done. Both types of samples were collected throughout the year, so it was not the case that EnSafe started sampling for total particles in January and switched to respirable particles later in the year. As an example, for Amphibious Excavator Operator, the first respirable sample was collected on January 19, 2009 and the first total particle sample was collected on January 22, 2009. This is another example of the lack of any apparent sampling strategy followed by EnSafe.

More silica and metals samples were collected in 2009 than in any other year, but as discussed above there is no obvious rationale behind selection of 5 activity/tasks to focus on for these contaminants.

| SEG/Actvity & Task | Contaminant measured | | | | Notes |
|---|---|---|---|---|---|
| | Total Particles | Respirable Particles | Silica | Metals | |
| Site-Wide Support | | | | | |
| Mgmnt/admin | 1 | 2 | 2 | 1 | |

| | | | | | |
|---|---|---|---|---|---|
| Security | 6 | 3 | 3 | 4 | |
| On-Land Operations | | | | | |
| Amphib Excav Op | 23 | 27 | 27 | 15 | |
| Buggy Op | 1 | 1 | 1 | 1 | |
| Dozer Op | 20 | 21 | 21 | 13 | |
| Excavator Op | 1 | 1 | 1 | 1 | |
| Grader Op | 2 | 3 | 3 | 1 | |
| Drill Crew | 1 | 1 | 1 | 1 | |
| On Water Operator | | | | | |
| Boat Op | 2 | 2 | 1 | 1 | |
| Dredge Boat Op | 0 | 2 | 2 | 0 | |
| Vacuum Barge Op | 1 | 1 | 1 | 0 | |
| On Water Laborer | | | | | |
| Boat laborer | 1 | 0 | 0 | 0 | |
| Deck Hand | 0 | 2 | 2 | 0 | |
| Teamster | | | | | |
| Artic Dump Trk Op | 15 | 17 | 17 | 7 | |
| Dump Trk Op | 6 | 5 | 5 | 8 | |
| Vacuum Trk Op | 1 | 2 | 2 | 1 | |
| Water Truck Op | 1 | 0 | 0 | 0 | |
| Railcar Loadout Operator | | | | | |
| Railcar Loading - Dozer | 0 | 1 | 1 | 0 | |
| On-Land Laborer | | | | | |
| Flagger | 18 | 15 | 15 | 14 | |
| Gen Laborer | 17 | 16 | 16 | 11 | |
| River Ops | 3 | 3 | 3 | 3 | |
| **Totals** | **120** | **125** | **124** | **82** | |

**Table 3. Samples collected in 2009.**

Samples collected in 2010 are summarized in **Table 4** below. Sampling continued in the same activity/tasks as in 2009, but at a reduced level and with a focus on respirable (125) and total (67) mass sampling. Only 29 silica and 6 metals samples were collected.

No rationale could be found in any of the documents for the decision to focus on total particle mass sampling for some activity/tasks (e.g., dozer and articulated dump truck operator and railcar loadout laborer), and to focus on respirable mass sampling for others (e.g., railcar closer, liner, dozer and excavator). There is no indication why total particle sampling (TPS) was performed for dozer operators, but respirable particle sampling (RPS) was performed for railcar loading – dozers. Likewise, there is no indication why RPS samples for most railcar operations were collected, but TPS samples for loadout laborer were collected. Further, there is no explanation as to why silica sampling was reduced by 76% and metals sampling was reduced by 92% from the previous year, while keeping RPS sampling constant. There are no obvious reasons for any of these sampling decisions, and none of them are explained in the documentation.

| SEG/Actvity & Task | Contaminant measured | | | | Notes |
|---|---|---|---|---|---|
| | Total Particles | Respirable Particles | Silica | Metals | |
| Site-Wide Support | | | | | |
| Field Staff | 0 | 2 | 0 | 0 | |
| Sample Technician | 1 | 2 | 0 | 0 | |
| On-Land Operations | | | | | |
| Amphib Excav Op | 5 | 3 | 3 | 1 | |
| Dozer Op | 12 | 0 | 1 | 1 | |
| Excavator Op | 4 | 0 | 0 | 0 | |
| Grader Op | 3 | 0 | 0 | 0 | |
| Scraper Pan Op | 0 | 23 | 1 | 0 | |
| Drill Crew | 0 | 2 | 2 | 0 | |
| Hydroseed Crew | 0 | 6 | 0 | 0 | |
| On-Water Operator | | | | | |
| Dredge Boat Op | 0 | 1 | 1 | 0 | |
| On-Water Lab | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Boat Laborer | 1 | 2 | 2 | 0 | |
| Mechanic | | | | | |
| Heavy Equip M | 1 | 11 | 0 | 1 | |
| Filter Press Operations | | | | | |
| Filter Press Op | 1 | 1 | 1 | 1 | |
| Teamster | | | | | |
| Artic Dump Trk Op | 11 | 2 | 2 | 0 | |
| Dump Trk Op | 1 | 2 | 0 | 0 | |
| Water Truck Op | 2 | 9 | 1 | 0 | |
| Railcar Loadout Laborer | | | | | |
| Loadout Laborer | 11 | 0 | 0 | 0 | |
| Railcar L - Closer | 2 | 21 | 3 | 0 | |
| Railcar L – Liner | 0 | 12 | 1 | 0 | |
| Railcar Loadout Operator | | | | | |
| Railcar L – Dozer | 1 | 9 | 6 | 0 | |
| Railcar L – Excav | 0 | 10 | 3 | 0 | |
| On-Land Laborer | | | | | |
| Decon Laborer | 0 | 2 | 0 | 0 | |
| Decon laborer (vac) | 2 | 0 | 0 | 0 | |
| Flagger | 5 | 3 | 3 | 1 | |
| Gen Laborer | 3 | 1 | 0 | 1 | |
| River Ops – Sh L | 1 | 0 | 0 | 0 | |
| **Totals** | **67** | **125** | **29** | **6** | |

**Table 4. Samples collected in 2010.**

Samples collected in 2011 are summarized in **Table 5** below. No TPM samples were collected, but respirable mass samples increased to 316 and silica to 180, both maxima for any year, and only 20 metals samples were collected. RPM sampling focused heavily on just seven activity/tasks, which accounted for 217 out of the 316 samples (68%). The remaining 99 samples were scattered

across 17 activity/tasks; as in other years, no justification was found in the documentation for this focus on a limited number of activity/tasks.

As discussed above, it is appropriate to analyze TPM samples for metals, but no TPM samples were collected in 2011, so the metals analyses were performed on RPM samples. This would have *substantially* reduced the measured toxic metal concentrations and thus underestimated the worker exposures.

| SEG/Actvity & Task | Contaminant measured | | | | Notes |
|---|---|---|---|---|---|
| | Total Particles | Respirable Particles | Silica | Metals | |
| Site-Wide Support | | | | | |
| Field Staff | 0 | 27 | 11 | 2 | |
| Mgmnt/Admin | 0 | 1 | 0 | 0 | |
| Sample Technician | 0 | 26 | 10 | 2 | |
| On-Land Operations | | | | | |
| Amphib Excav Op | 0 | 9 | 3 | 1 | |
| Booster Pump Op | 0 | 2 | 0 | 0 | |
| Crane Op | 0 | 2 | 0 | 0 | |
| Dozer Op | 0 | 33 | 16 | 2 | |
| Excavator Op | 0 | 30 | 16 | 1 | |
| Firklift Op | 0 | 2 | 2 | 0 | |
| Grader Op | 0 | 1 | 1 | 0 | |
| Scraper Pan Op | 0 | 13 | 2 | 0 | |
| Drill Crew | 0 | 10 | 8 | 2 | |
| Mechanic | | | | | |
| Heavy Equipment M | 0 | 9 | 5 | 3 | |
| Perimeter Wall Crew | | | | | |
| BP_Forklift Operator | 0 | 3 | 3 | 0 | |
| BP_Gen Laborer | 0 | 4 | 3 | 1 | |
| BP_Mixing Crew | 0 | 31 | 28 | 2 | |
| Teamster | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Artic Dump Trk Op | 0 | 27 | 13 | 1 | |
| Dump Trk Op | 0 | 4 | 0 | 0 | |
| Fuel Truck Driver | 0 | 6 | 3 | 1 | |
| Water Truck Op | 0 | 19 | 8 | 0 | |
| Railcar Loadout Laborer | | | | | |
| Loadout Laborer | 0 | 5 | 3 | 0 | |
| On-Land Laborer | | | | | |
| Decon Laborer | 0 | 14 | 10 | 0 | |
| Flagger | 0 | 43 | 22 | 2 | |
| Gen Laborer | 0 | 13 | 11 | 0 | |
| River Ops | 0 | 9 | 2 | 0 | |
| **Totals** | | **316** | **180** | **20** | |

**Table 5. Samples collected in 2011.**

Samples collected in 2012 are summarized in **Table 6** below. No total particle mass nor metals samples were collected during this year, and no justification could be found for the decision to stop sampling for toxic metals. The number of respirable mass samples was about half of the number collected in the previous year, again without explanation. The number of silica samples was somewhat less than the RPM samples; in most cases, the same filter was analyzed for both contaminants, but for 25% of the samples, only RPM was measured. Again, no justification could be found for the individual decisions on whether or not to analyze a particular sample for silica.

| SEG/Actvity & Task | Contaminant measured | | | | Notes |
|---|---|---|---|---|---|
| | Total Particles | Respirable Particles | Silica | Metals | |
| Site-Wide Support | | | | | |
| Field Staff | 0 | 4 | 4 | 0 | |
| Sample Tech | 0 | 14 | 11 | 0 | |
| On-Land Operations | | | | | |
| Amphib Excav Op | 0 | 1 | 1 | 0 | |
| Dozer Op | 0 | 6 | 4 | 0 | |
| Excavator Op | 0 | 9 | 3 | 0 | |
| Grader Op | | | | | |
| Scraper Pan Op | 0 | 5 | 1 | 0 | |

| | | | | | |
|---|---|---|---|---|---|
| Drill Crew | 0 | 25 | 15 | 0 | |
| Hydroseed Crew | 0 | 7 | 5 | 0 | |
| Mechanic | | | | | |
| Heavy Equip M | 0 | 7 | 4 | 0 | |
| Perimeter Wall Crew | | | | | |
| BP_Forklift Op | 0 | 15 | 15 | 0 | |
| BP_Gen Laborer | 0 | 13 | 11 | 0 | |
| BP_Mixing Op | 0 | 60 | 52 | 0 | |
| Teamster | | | | | |
| Artic Dump Trk Op | 0 | 9 | 9 | 0 | |
| Dump Trk Op | 0 | 1 | 0 | 0 | |
| Fuel Truck Driver | 0 | 1 | 0 | 0 | |
| Vacuum Trk Op | 0 | 1 | 1 | 0 | |
| Water Truck Op | 0 | 5 | 2 | 0 | |
| On-Land Laborer | | | | | |
| Flagger | 0 | 7 | 4 | 0 | |
| Gen Laborer | 0 | 2 | 1 | 0 | |
| **Totals** | **0** | **192** | **143** | **0** | |

**Table 6. Samples collected in 2012.**

Samples collected in 2013 are summarized in **Table 7** below. Samples were only collected and analyzed for RPM and Si. Once again, no reasons could be found in the documents reviewed for the failure to sample for TPM and metals. The number of samples collected continued to decrease from the previous year, also with no explanation.

| SEG/Actvity & Task | Contaminant measured | | | | Notes |
|---|---|---|---|---|---|
| | Total Particles | Respirable Particles | Silica | Metals | |
| Site-Wide Support | | | | | |
| Field Staff | 0 | 8 | 7 | 0 | |
| Sample Tech | 0 | 1 | 1 | 0 | |
| On-Land Operations | | | | | |
| Amphib Excav Op | 0 | 1 | 1 | 0 | |
| Dozer Op | 0 | 2 | 1 | 0 | |

| | | | | | |
|---|---|---|---|---|---|
| Excavator Op | 0 | 6 | 6 | 0 | |
| Grader Op | 0 | 3 | 3 | 0 | |
| Scraper Pan Op | 0 | 1 | 1 | 0 | |
| Drill Crew | 0 | 13 | 13 | 0 | |
| Hydroseed Crew | 0 | 8 | 7 | 0 | |
| Mechanic | | | | | |
| Heavy Equip M | 0 | 8 | 7 | 0 | |
| Perimeter Wall Crew | | | | | |
| BP_Forklift Op | 0 | 2 | 2 | 0 | |
| BP_Gen Laborer | 0 | 3 | 3 | 0 | |
| BP_Mixing Op | 0 | 10 | 10 | 0 | |
| Teamster | | | | | |
| Artic Dump Trk Op | 0 | 5 | 5 | 0 | |
| Water Truck Op | 0 | 7 | 7 | 0 | |
| Railcar Loadout Lab | | | | | |
| Railcar L - Liner | 0 | 4 | 4 | 0 | |
| On-Land Laborer | | | | | |
| Gen Laborer | 0 | 13 | 12 | 0 | |
| **Totals** | **0** | **95** | **90** | **0** | |

**Table 7. Samples collected in 2013.**

Samples collected in 2014 are summarized in **Table 8** below. Only a few samples were collected in this year, but most of them were the reintroduction, for the first time since 2010, of TPM sampling, accompanied by a metals analysis of all of the TPM samples. Only 10 RPM samples were collected, all of which were also analyzed for Si. Only 13 different activity/tasks were sampled in 2014, and once again no rationale could be found for their selection.

| SEG/Actvity & Task | Contaminant measured | | | | Notes |
|---|---|---|---|---|---|
| | Total Particles | Respirable Particles | Silica | Metals | |
| Site-Wide Support | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Field Staff | 4 | 1 | 1 | 4 | |
| On-Land Operations | | | | | |
| Dozer Op | 0 | 1 | 1 | 0 | |
| Excavator Op | 2 | 0 | 0 | 2 | |
| Grader Op | 2 | 0 | 0 | 2 | |
| Scraper Pan Op | 1 | 0 | 0 | 1 | |
| Hydroseed Crew | 4 | 2 | 2 | 4 | |
| Mechanic | | | | | |
| Heavy Equip M | 4 | 1 | 1 | 4 | |
| Perimeter Wall Crew | | | | | |
| BP_Gen Laborer | 0 | 1 | 1 | 0 | |
| BP_Mixing Op | 0 | 2 | 2 | 0 | |
| Teamster | | | | | |
| Artic Dump Trk Op | 4 | 2 | 2 | 4 | |
| Water Truck Op | 2 | 0 | 0 | 2 | |
| Railcar Loadout Lab | | | | | |
| Railcar L - Liner | 4 | 0 | 0 | 4 | |
| On-Land Laborer | | | | | |
| Gen Laborer | 5 | 0 | 0 | 5 | |
| | | | | | |
| Unknown SEG | 9 | 0 | 0 | 9 | "Cap laborer" |
| **Totals** | **41** | **10** | **10** | **41** | |

**Table 8. Samples collected in 2014.**

The total number of samples collected in each year is presented in **Table 9** below. The total number of analyses performed was 1,834. Although this may seem like a relatively large number, once examined in context it is clear that the IH sampling performed at the Kingston site was wholly inadequate.

Since samples were only collected on the last day of 2008, the sampling period can be considered to be 6 years. The data reviewed does not indicate how many workers were actually on the job in

each activity/task in each year, although Mr. Bock, Jacobs EHS leader, testified that on a shift change about 200 workers left the site,[48] which would be an average of 3-4 per SEG/activity/task.

I will assume for illustration that at least one worker was working in each activity/task in each year. Then, 63 activity/tasks x 6 years x 4 sample types = 1,512 unique sampling opportunities – 1,512 samples needed in order to have collected one sample per activity/task per contaminant per year.

As shown in the last table entry, the total analyses of 1,834 corresponds to 1.2 samples per activity per contaminant per year. Looking at the different contaminants, metals samples were collected at the lowest rate (0.4 samples per activity/task per year), while RPM was sampled at the highest rate (2.3 samples per activity/task per year).

| Year | Total Particles | Respirable Particles | Silica | Metals | **Total** |
|---|---|---|---|---|---|
| 2008 | 5 | 0 | 0 | 13 | **18** |
| 2009 | 120 | 125 | 124 | 82 | **451** |
| 2010 | 67 | 125 | 29 | 6 | **227** |
| 2011 | 0 | 316 | 180 | 20 | **516** |
| 2012 | 0 | 192 | 143 | 0 | **335** |
| 2013 | 0 | 95 | 90 | 0 | **185** |
| 2014 | 41 | 10 | 10 | 41 | **102** |
| Total | 233 | 863 | 576 | 162 | **1834** |
| Samples/SEG | 3.7 | 13.7 | 9.1 | 2.6 | **29** |
| Samples/SEG/year | 0.6 | 2.3 | 1.5 | 0.4 | **4.8** |
| Smple/SEG//type/yr | | | | | **1.2** |

**Table 9. Total number of samples collected, by year and sample type.**

### B. Statistical Analysis of Industrial Hygiene Sampling

As described above, the SWHSP promised to collect sufficient samples "…until all exposure groups have been adequately characterized until at least a 95 percentile confidence interval has been achieved." This statement is imprecise, i.e., 95% confidence in *what*, exactly?

The industrial hygiene literature has long addressed the statistical aspects of exposure assessment. A classic publication widely used for more than forty years is the NIOSH *Occupational Exposure*

[48] Doc. No. 414 – K. Thompson, Robinette, Brewer, Bock-117, p. 697.

*Sampling Strategy Manual*,[49] which will be used to reference some basic concepts. NIOSH describes how it is desirable to first sample the workers at highest risk of exposure; presumably, at the Kinston cleanup site that would not be known a priori because of the episodic nature of the worker being performed. NIOSH then states:

> If a maximum risk worker cannot be selected for an operation with reasonable certainty, then it is necessary to resort to random sampling of the group of workers. The procedure is to randomly sample the group whose members have a similar expected exposure risk. The objective of the procedure is to select a subgroup of adequate size so that there is a high probability that the random sample will contain at least one worker with high exposure if one exists.[50]

In our case, the groups with "similar expected exposure risk" are the designated SEG/activity/tasks. The objective is to ensure that a worker with high exposure is sampled, but that is not explicitly stated in the SWHSP. As NIOSH discusses, the typical exposure level selected is the highest 10%, so the proper statistical question to be asked is what is "…the required sample size n of a random sample drawn from a group of size N (N = 1 to 50) which ensures with 90% confidence [in Jacobs' case, 95%] that at least one individual from the highest 10% exposure group is contained in the sample."[51] NIOSH includes **Table A-2**, giving n for various values of N under these conditions, reproduced below.

| Size of group (N) | 12 | 13-14 | 15-16 | 17-18 | 19-21 | 22-24 | 25-27 | 28-31 | 32-35 | 36-41 | 42-50 | ∞ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Required No. of measured employees (n) | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 29 |

**Table A-2. Sample size for top 10% and confidence 0.95 (use n = N if N ≤11).**[52]

Thus, the procedure that EnSafe/Jacobs *should* have followed was to first determine the number of workers in each activity/task, then use **Table A-2** to determine the number of workers to be sampled, then randomly select that number of workers from each group. Note that if the number of workers in a particular activity/task was 11 or fewer, EnSafe and Jacobs would have been required to sample *all* of the workers in that group for *all* of the contaminants of interest. There is no evidence in the documentation provided that this process was followed, and if it was in fact followed, what the results were.

This represents that, again, Jacobs failed to comply with established industrial hygiene protocols. This failure, which implicates the methods used for collecting samples, affects the testing results.

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49 Leidel, et al., *Occupational Exposure Sampling Strategy Manual*, National Institute for Occupational Safety and Health, DHEW (NIOSH) Pub. No. 77-173, 1977.

50 NIOSH, p. 34.

51 NIOSH, p. 35.

52 NIOSH, p. 72.

This demonstrates that the IH monitoring performed at the Kingston Site was wholly inadequate, and is unreliable.

## XI. Inconsistencies and Errors of the Measured Concentrations

This section discusses general issues with the measured contaminant concentrations. Specific measurements of specific SEG/Activity/tasks are included in the attached Addenda for each individual plaintiff.

### A. Respirable Mass Sampling

Most of the measured concentrations were for respirable particulate matter ("RPM"), which is an industrial hygiene concept for particles small enough to deposit in the alveolar region of the lung. The corresponding quantity used in air pollution studies is PM2.5, i.e., particles with diameters smaller than 2.5 μm. RPM and PM 2.5 are roughly equivalent, since they both measure alveolar deposition. EPA ambient air quality measurements in the Kingston region found that the average PM2.5 concentration in 2009 was 12 $\mu g/m^3$ (0.012 $mg/m^3$) and falling from year to year.[53] This means that any measured worker concentrations to RPM that exceeded 12 μg/m3 would have been due to occupational exposures to resuspended fly ash.

EnSafe and Jacobs relied on the permissible exposure limit ("PEL") of 5 mg/m3 for respirable "particulates not otherwise regulated," also called nuisance dust, in determining if workers were exposed to dangerous levels of RPM. This can be seen in the only monthly progress reports found in the provided documents, those from 2010. For example, Jacobs' first "Monthly Industrial Hygiene Monitoring Summary, July 2010"[54] reports that two RPM samples were collected for the Drill Crew SEG. At that time, Jacobs was using a PEL of 3 $mg/m^3$ and an action level (where steps needed to be taken to reduce exposure) of 1.5 $mg/m^3$ (these were later raised to 5 and 2.5). The measured time-weighted average exposures were 0.244 and 1.08 $mg/m^3$. Their conclusion states:

> Jacobs performed air monitoring on two Drill Crew SEG individuals on a single day. RJ Lee Laboratory provided raw results. After we performed the Time Weighted Average (TWA) calculations, Jacobs requested further analysis after determining the raw results for respirable dust were high enough that they could potentially pose a silica exposure. The respirable dust results and the Silica results are below the action levels and are an insignificant exposure not requiring any follow-up sampling for this exposure group.

The exact same conclusion language is used for every SEG sampled in 2010, as reported in the monthly reports. These conclusions are problematic and erroneous for several reasons.

First, there is no discussion as to why only two Drill Crew SEG members were tested. If there were more than two members of this group, Jacobs failed to comply with the NIOSH *Occupational Exposure Sampling Strategy Manual*. As discussed above in **Table A-2**, the exposure assessment guidelines require all group members to be sampled until the group size exceeds 11 members.

[53] http://www.usa.com/kingston-tn-air-quality.htm

[54] JEGS 0071481 – IH 2010, p. 2.

Additionally, if the group was larger than two members, there is no discussion on how these two individuals were selected. Therefore, it cannot be determined if they were selected randomly, as required by the rules of exposure assessment, or whether another method was used.

Second, samples were selected for Si analysis based on having a "high" RPM concentration. However, there is again no discussion provided in any of the reviewed documents as to what constitutes an RPM concentration that is "high enough" to warrant Si analysis.

Finally, EnSafe and Jacobs' reliance on the PEL for respirable "particulates not otherwise regulated," also called nuisance dust, is *not* appropriate for fly ash. This is because fly ash is a complex material containing many highly toxic and carcinogenic substances. Since fly ash is highly toxic, exposures to respirable particles at concentrations above the ambient background presents an increased risk of disease to the workers. The dangers of respirable particle exposure at low concentrations is well-known. For example, in 2005 the World Health Organization ("WHO") recommended that PM $PM_{2.5}$ concentrations not exceed 10 $\mu g/m^3$.[55]

For these reasons, Jacobs failed to comply with appropriate industrial hygiene protocols in regards to its respirable mass sampling.

### B. Silica Sampling

The silica sampling results show strong indications that the analysis was somehow faulty. The distribution of reported concentrations does not appear to be possible. One would expect that the measured Si concentrations would cover some range, from just above the limit of detection ("LOD") to some maximum value, with the actual measured values distributed randomly in between.

However, an extremely large fraction of the reported values was exactly identical at a reported concentrated of 0.01 $mg/m^3$. This is illustrated in **Table 10** below. It is hard to imagine any actual field conditions where almost 50% of random samples collected from workers in 63 different exposure groups over a period of six years would have the same measured exposure. This, at a minimum, raises concerns as to the sampling and analytical procedures followed for the silica exposure assessment.

| Year | Number of Si samples | | |
|---|---|---|---|
| | Conc. Above LOD | Conc. = 0.01 $mg/m^3$ | Percentage |
| 2009 | 19 | 6 | 32 |
| 2010 | 7 | 0 | 0 |
| 2011 | 123 | 51 | 41 |
| 2012 | 40 | 26 | 65 |

[55] World Health Organization, *WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide, Global update 2005, Summary of risk assessment,* WHO/SDE/PHE/OEH/06.02, 2006.

| | | | |
|---|---|---|---|
| 2013 | 11 | 9 | 82 |
| 2014 | 3 | 1 | 33 |
| **Totals** | **203** | **93** | **46** |

**Table 10. Percentage of Si sample concentrations exactly equal to 0.01 mg/m³.**

### C. Metals Sampling

Most, if not all, of the few samples analyzed for metals showed nondetectable levels of Pb, As and Cd. However, the analytical methods used were not sufficiently sensitive to detect these metals at the concentrations typically found in fly ash. This can be illustrated by an example.

On June 13, 2011, Flagger Dennis Smith was monitored for exposure to RPM and toxic metals, as documented on pp. 403, 411 and 424 of Vol 2 of Jacobs' 2011 IH production. His measured RPM concentration was 0.065 mg/m³, and the Pb analysis found that the Pb concentration was below the LOD, which is given on p. 403 as 0.00040 mg/m³. Taking the ratio of Pb to RPM concentration gives the fractional Pb concentration:

Pb fraction = 0.0004/0.065 = 0.006

Converting to µg/g:

Pb concentration = $0.006 \times 10^6$ µg/g = 6000 µg/g

This is the minimum Pb concentration that would have to be present in the fly ash in order for the sample result to exceed the laboratory's limit of detection. This concentration, however, is four times higher than the level of Pb reported in fly ash particles of respirable size, which is 1500 µg/g.[56] This would indicate that the analytical method used by the laboratory to analyze metal concentrations was not sufficiently sensitive to detect the typical concentrations found in fly ash.

## XII. Indicators of Manipulation and Inadequacies of Sampling Resulting in Unreliable Data

There are several indicators of manipulation and inadequacies of the IH sampling performed at the Kingston site. These reasons are discussed below.

### A. Lack of Biological Monitoring

The only way an industrial hygienist could properly assess the likely contribution of ingestion to a worker's total body burden of a contaminant would be to perform biological monitoring of that worker. This is readily accomplished. For example, the American Conference of Governmental Industrial Hygienists (ACGIH) has established Biological Exposure Limits (BEIs®) for arsenic in

[56] Davison, et al., Trace elements in fly ash: Dependence of concentration on particle size, ES&T 8(3):1107-13 (1974).

urine, cadmium in urine and blood, and lead in blood.[57] There is no evidence in the documents reviewed that biological monitoring was ever performed on any worker.

### B. Effect of Rain on Sampling

On the Kingston site, much of the worker exposure to fly ash and its constituents would have been due to airborne dust kicked up by all of the various equipment being used to manipulate the spilled ash. It is certain that when the ground was dry, much more dust was generated than when the ground was wet. In fact, the contractors employed water trucks for the express purpose of knocking down the dust. Rain will have the same effect as the water trucks, and more so since rain will cover the entire site. Rain would have been much more effective at reducing the dust.

Trial Exhibits 85 – 94 present summaries of rain days and air sampling days for 2009 – 2013. They show a significant overlap between the two. On all days where it was raining when sampling occurred we can assume that the measured airborne concentrations were substantially reduced, thus making the results inadequate. This demonstrates that Jacobs' sampling, and in turn its testing data, was unreliable, and at worst it illustrates that Jacobs actively manipulated the data.

### C. Evidence of Sample Tampering

Workers have testified that they witnessed sample tampering by contractor personnel. Sample mishandling and deliberate abuse, such as hitting the side of a filter cassette, will have the effect of reducing the measured worker exposure and certainly constitutes a serious violation of industrial hygiene ethics. There is video evidence of contractor personnel hitting the side of a monitor.

## XIII. Individualized Exposure Assessments

I have conducted individualized exposure assessments of each plaintiff in this matter. Each assessment is attached as an Addendum to this report, which are collectively attached here as Exhibit D.

## XIV. Conclusions

The principal conclusions I have reached regarding the adequacy of the EnSafe/Jacobs industrial hygiene sampling program, as discussed in detail above, are as follows.

First, the Site Wide Safety and Health Plan ("SWSHP") defined 14 similar exposure groups (SEGs), further broken down into 63 activity/tasks, based on expected similar exposures. However, no discussion is provided as to the actual rationale used to define any of the groups. Furthermore, no comprehensive reports were included in the document production that summarized the air sampling that was performed, the rationale behind that air sampling, nor the results. Therefore, Plaintiffs were required to undertake the laborious task of evaluating thousands of pages of field notes, laboratory analytical reports, and letters to individual workers, in order to collect and evaluate the results of the air sampling that was performed.

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[57] ACGIH, 2020 TLVs® and BEIs® Based on the Documentation of the Threshold Limit Values for Chemical Substances and Physical Agents & Biological Exposure Indices, 2020.

Second, the SWSHP states that "...monitoring will be performed until all exposure groups have been adequately characterized until at least a 95 percentile confidence interval has been achieved." This was not accomplished, for the following reasons:

1. In the crucial first year after the accident (2009), samples were collected in only 20 of the 63 activity/tasks, and only 8 of the 20 had 5 or more samples collected.
2. In the first two years (2009, 2010), only 31/63 activity/tasks had any samples collected, and only 18/63 had 5 or more samples collected.
3. Over the entire sampling period, 2008 – 2014, 21 out of 63 activity/tasks (33%) were *never* sampled to determine the typical exposures for that SEG.
4. Based on the lack of sampling for the vast majority of activity/tasks and the lack of adherence to the NIOSH exposure assessment protocol, it is impossible to calculate representative airborne exposures with 95% confidence for any worker in any year, as claimed in the SWHSP.

Third, EnSafe/Jacobs' reliance on the PEL of 5 $mg/m^3$for respirable "particulates not otherwise regulated", also called nuisance dust, is not appropriate for fly ash, since fly ash is a complex material containing many highly toxic and carcinogenic substances. Since fly ash is highly toxic, and exposures to respirable particles at concentrations above the ambient background presents an increased risk of disease to the workers, this testing was inadequate. The dangers of respirable particle exposure at low concentrations is well-known. The World Health Organization recommends that $PM_{2.5}$concentrations not exceed 10 $\mu g/m^3$.

Furthermore, Silica sampling analytical results show a pattern that does not seem realistic, based on the certainty that actual silica exposures were randomly distributed over some range.

Next, most if not all of the few samples analyzed for metals showed nondetectable levels of Pb, As and Cd. However, the analytical methods used were not sufficiently sensitive to detect these metals at the concentrations typically found in fly ash.

Additionally, there was no biological monitoring performed. Photographs and worker testimony document the frequent heavy contamination of workers' clothing and skin with fly ash, which certainly lead to additional exposure by ingestion. The only way to quantify such exposures is through extensive biological monitoring, but the evidence is that no biological monitoring was performed.

Next, the use of proper respiratory protection and other PPE would have reduced worker exposures considerably, but the evidence is that such PPE was not provided to the workers and in fact its use was actively discouraged.

Finally, the sample data is unreliable because much of the IH sampling was performed on rainy days, which would have reduced the amount of airborne dust by a large fraction. Additionally, worker testimony and video evidence indicate that many samples were tampered with, reducing confidence in the validity of the reported results.

Overall, EnSafe/Jacobs collected relatively few worker exposure samples, and the sampling that they did perform was haphazard with no discernable goal to characterize all worker exposures. The measured concentrations in the samples that were collected were erroneously compared to nuisance dust standards and thus erroneously judged to be "safe". In fact, all samples that found concentrations exceeding the ambient background concentration were hazardous to the workers.

The sampling was often performed in the rain, and workers reported frequent sample tampering. In addition, EnSafe/Jacobs failed to take simple steps to protect workers' health, such as providing respirators and other PPE.

For all of the above reasons, it is my scientific opinion that EnSafe and Jacobs Engineering failed to provide workers at the Kingston Ash Removal Site with a safe place to work. Many, if not all, workers at that site were exposed to hazardous levels of airborne fly ash and its constituents, including silica and toxic metals, and that exposure increased their risk of developing work-related diseases.

Michael Ellenbecker, Sc.D, CIH

# EXHIBIT A

**Updated: 24 August 2020**

# CURRICULUM VITAE

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**Current Position**

Professor Emeritus of Occupational and Environmental Hygiene
Department of Public Health

Co-Director, September 2019 - present
Director, October 2003 – September 2019
Deputy Director, October 1999 - October 2003
Acting Director, July 1998 - September 1999
Associate Director, September 1991 - June 1998
Toxics Use Reduction Institute

University of Massachusetts Lowell
One University Avenue
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**Education**

| Institution | Degree | Year | Field |
|---|---|---|---|
| Harvard University | Sc.D. | 1979 | Environmental Health Sciences |
| Harvard University | M.S. | 1976 | Environmental Health Sciences |
| The University of Wisconsin | M.S. | 1969 | Electrical Engineering |
| The University of Minnesota | B.E.E. | 1967 | Electrical Engineering |

## Professional Certification

Certified in the Comprehensive Practice of Industrial Hygiene, American Board of Industrial Hygiene, 1982 (No. 2212); recertified through December 1, 2026.

## Professional Experience

1986-2014 Professor Emeritus (Sep 2014 – present)
Professor of Occupational and Environmental Hygiene (1989-2014)
Associate Professor of Industrial Hygiene (1986-1989)
Graduate Coordinator (1987-2000)
Department of Work Environment
(name changed to Department of Public Health, 2016)
University of Massachusetts Lowell
Lowell, MA.

Co-Director, September 2019 - present
Director, October 2003-September 2019
Deputy Director (September 1999-October 2003)
Acting Director (July 1998-August 1999)
Associate Director for Research (1989-1999)
Toxics Use Reduction Institute
University of Massachusetts Lowell

Research Activities:

Development of techniques to reduce the use of toxic chemicals;

Nanoparticle exposure evaluation and control;

Development of software-based health and safety tools;

Evaluation of exposures of former DOE workers;

Evaluation of the asbestos exposure of school custodians;

Design and evaluation of industrial ventilation systems;

Development of sampling protocols for thermal emissions from plastics processing operations;

Evaluation of respirator performance against asbestos aerosols;

Health effects of trash-to-energy facilities.

Courses Taught:

Aerosol Science;

Industrial Ventilation;

Engineering Controls and Personal Protective Equipment;

Control of Physical Agents;

Industrial Hygiene;

Noise and Vibration Control;

Toxics Use Reduction and Pollution Prevention;

Introduction to the Work Environment.

1978- Consultant: industrial hygiene, air pollution, indoor air quality.

1980- Lecturer (1986 - present)
Associate Professor (1986)
Assistant Professor (1980-1986)
Harvard University School of Public Health
Boston, MA.

Director, Industrial Hygiene Program
Harvard Educational Resource Center

Research Activities:

Design and evaluation of industrial ventilation systems;

Evaluation of respirator performance against asbestos aerosols;

Fundamental principles of fabric filtration;

Characterization and control of indoor air pollution sources;

Characterization of emissions from residential coal and wood stoves;

Health hazard evaluations of several industries, including chemical plants, woodworkers, a chlor-alkali plant, and chemistry laboratories.

Courses taught:

Ventilation;

Aerosol Technology;

Noise and Vibration Control;

Principles of Industrial Hygiene;

Air and Gas Cleaning;

Tutorials and Directed Research in Industrial Hygiene and Air Pollution Control.

1978-1980 Senior Research Engineer; Harvard School of Public Health; Boston, MA.

Research Activities:

Performance of pulse-jet fabric filters;

High velocity fibrous filtration.

1973-1975 System Program Manager; U.S. Air Force, Electronics Systems Division; Hanscom AFB, MA.

1969-1973 System Survivability Analyst; U.S. Air Force, Air Force Weapons Laboratory; Kirtland AFB, NM.

1967 Engineer; Northwestern Bell Telephone Company, St. Paul, MN.

**Professional Activities**

UMass Lowell Service Activities:

Graduate Coordinator, Dept. of Work Environment, 1987-2004.

Member, Faculty Senate, 1995-1999, 2012-2013.

Member, University Indoor Environmental Quality Committee, 1995-present

Member, Graduate School Dean Search Committee, 1992.

Leader, Second Field Study and Exchange Delegation to the Peoples' Republic of China, June-July, 1983.

Member, Board of Directors, American Lung Association of Massachusetts, 1982-1988.

Chairman - Environmental Quality Committee, 1983-1988.

Member, Commonwealth of Massachusetts Special Commission on Indoor Air Pollution, 1987-1989. Appointed by the Governor.

Member, National Institutes of Health Safety and Occupational Health Study Section, 1990-1993.

Editor, Engineering Section, and Editorial Board member, New Solutions, 1991-1998.

Peer Reviewer, Applied Occupational and Evironmental Hygiene, American Industrial Hygiene Association Journal, Aerosol Science and Technology, The Annals of Occupational Hygiene, Journal of Nanoparticle Research, Journal of Cleaner Production.

Visiting Lecturer on Industrial Hygiene, Exposure Assessment Engineering Program, Harvard School of Public Health, 1993-present.

Member, KomTek Corporation Occupational Illness Prevention Advisory Board, 1994-present.

Visiting Scientist, Occupational Studies Section, National Cancer Institute, January-May, 1995.

Member, Minimization Working Group, Commonwealth of Massachusetts Low-Level Radioactive Waste Management Board, 1997-2003.

Member, National Institutes of Health Safety and Occupational Health Special Emphasis Panel, 2001.

Member, National Institutes of Health Safety and Occupational Health Special Emphasis Panel, 2002.

Chair, National Institutes of Health Safety and Occupational Health Training Grant Initial Review Panel, 2003.

Member, National Institutes of Health Safety and Occupational Health Special Emphasis Panel, 2006.

Member, National Institutes of Health Safety and Occupational Health Special Emphasis Panel, 2007.

Co-Chair, 5th International Symposium on Nanotechnology, Environmental and Occupational Health, Boston, MA, 2011.

Associate Editor, Journal of Nanoparticle Research, 2012 – 2015.

Member, Board of Directors, American Conference of Governmental Industrial Hygienists, 2017 – 2022.
Chair, 2019

## Honors

Recipient, AIHA Henry F. Smyth, Jr., Award, 2015.

Sigma Xi, a scientific research society.

Mellon Fellow (1981-1983, Harvard School of Public Health).

Graduated with Distinction, University of Minnesota.

Selected as Outstanding Faculty Member, Work Environment Student Association, University of Massachusetts Lowell, 1993.

1997 Best Paper Award (with Thomas W. Rimmer), Applied Occupational & Environmental Hygiene Journal, awarded by the Michigan Industrial Hygiene Society at the American Industrial Hygiene Conference & Exposition.

Massachusetts Toxics Use Reduction Program selected as one of the top ten Innovations in American Government by the Ford Foundation, Harvard University's Kennedy School of Government, and the Council for Excellence in Government, 1999.

Winner (with Su-Jung Tsai), 2008 Best Paper Award by the AIHA Lab Health and Safety Committee for the paper entitled "Characterization of Fume Hood Performance while Handling Nanoparticles," presented at the American Industrial Hygiene Conference and Exposition, Minneapolis. July 2008.

## Grants, Contracts, and Awards

"Pulse-Jet Fabric Filter Performance"; EPA; 9/1/80 - 2/28/84, co-principal investigator; 3/1/84 - 9/30/84, principal investigator; $526,348.

"Health Effects of Residential Coal and Wood Burning"; New England States for Coordinated Air Use Management; 11/14/80 - 6/12/81; principal investigator; $23,499.

Mellon Foundation Faculty Development Program Grant; 7/1/81 - 6/30/83; $38,111.

"Assessment of Public Total Exposure to Selected Emission Species Contributed in Part by Indoor Sources"; Gas Research Institute; 7/83 - 6/84; co-principal investigator; $420,000.

"Asbestos Fiber Collection by NIOSH-Approved Respirators"; National Institute for Occupational Safety and Health; 1/86 - 6/87; principal investigator; $122,986.

"Assist in the Evaluation of a Proposed Refuse-to-Energy Facility"; City of Lowell; 3/87 - 3/88; investigator; $39,200.

"Ventilation System Evaluation and Design"; Pneumatic Scale Corporation; 3/89 - 7/89; principal investigator; $7,605.

"Development of Sampling Protocols for Thermal Emissions of Plastics"; Society of the Plastics Industry, Inc.; 8/1/89 - 1/31/91; investigator; $167,414.

"Epidemiologic Methods for Estimating Airborne Exposures"; National Institute for Occupational Safety and Health; 7/90 - 6/93; investigator; $223,769.

"Case-Control Study of Brain and Larynx Cancer at GM/UAW Plants"; General Motors - United Auto Workers National Joint Committee on Health and Safety; 11/89 - 1/91; investigator; $400,000.

"Industrial Hygiene Graduate Training"; National Institute for Occupational Safety and Health; 1/91 - 6/94; Program Director; $655,076.

"Assessment of the Building-Related Asbestos Exposure of Public School Custodians"; Health Effects Institute - Asbestos Research; 5/93 - 2/94; principal investigator; $116,000.

"Evaluation of Alternative Surface Cleaning Materials"; Environmental Protection Agency; 10/93 - 9/96; principal investigator; $292,386.

"Emission and Property Studies of Postconsumer High Density Polyethylene Waste"; Commonwealth of Massachusetts; 7/93 - 6/94; investigator; $52,000.

"A New Hearing Protector Attenuation Measurement Method"; National Institute for Occupational Safety and Health; 9/1/94 - 8/31/95; principal investigator; $26,362.

"Measuring State-Wide Progress in Pollution Prevention"; Environmental Protection Agency; 10/1/94 - 9/30/95; principal investigator; $49,996.

"Technology Transfer to Promote Alternative Chemical Technologies"; Environmental Protection Agency; 9/1/94 - 8/31/95; investigator; $119,824.

"Occupational Health and Safety Training Grant"; National Institute for Occupational Safety and Health; 7/95 - 6/2000; Program Director; $1,763,779.

"Department of Energy Former Workers' Medical Surveillance"; Oil, Chemical and Atomic Workers' Union; 10/96 - 9/97; principal investigator; $117,996.

"Medical Surveillance for Former Idaho Falls, Idaho, Workers"; Oil, Chemical and Atomic Workers' Union; 9/97 - 9/98; principal investigator; $82,537.

"Department of Energy Former Workers' Medical Surveillance, Phase II"; Oil, Chemical and Atomic Workers' Union; 7/98 - 6/02; principal investigator; $298,828.

"Intervention Effectiveness of Process Change Techniques"; National Institute for Occupational Safety and Health; 9/00 - 8/02; project supervisor; $76,208.

"Occupational Health and Safety Training Grant"; National Institute for Occupational Safety and Health;7/00 - 6/05; Principal Investigator; $1,812,251.

"Small Business Safety Officer"; subcontract to Mission Research Corporation, funded by National Institute for Occupational Safety and Health; 9/00 - 6/01; Principal Investigator; $10,000.

"Small Business Safety Officer"; subcontract to Mission Research Corporation, funded by National Institute for Occupational Safety and Health; 9/02 - 8/04; Principal Investigator; $150,000.

"TCE Use by Smaller Businesses in Massachusetts"; EPA Region I; Principal Investigator; $125,000.

"Nanoscale Science and Engineering Center," awarded to UMass Lowell, Northeastern University, & University of New Hampshire; NSF; 9/04 - 8/14; investigator; $30,000,000.

"Five Chemicals Alternatives Assessment"; Commonwealth of Massachusetts; 7/05 - 6/06; Principal Investigator; $250,000.

"Occupational Health and Safety Training Grant"; National Institute for Occupational Safety and Health;7/05 - 6/10; Principal Investigator; $1,900,000.

“Reducing Trichloroethylene in Rhode island Through On-site Assistance for Solvent Substitution,” EPA Region I; 9/07-12/08; Principle Investigator; $21,500.

Contract to prepare a guidance document titled “Safe Practices for Working with Engineered Nanomaterials in Research Laboratories”; National Institute for Occupational Safety and Health; 9/08 - 9/09; Principal Investigator; $25,000.

Contract to evaluate nanoparticle exposures and recommend best practices for handling nanoparticles; Specialty Materials, Inc.; 10/08; Principal Investigator; $10,000.

Contract to evaluate exposures to quantum dots; CLF Ventures, Inc.; 2/09 – 12/09; Principal Investigator; $17,200.

Contract to evaluate the performance of a powder handling enclosure, A1-Safetech, Principal Investigator; $2,990.

Contract to evaluate the performance of a powder handling enclosure, Labconco, Principal Investigator; $5,000.

Contract to provide nanoparticle exposure assessment, Nanocomp, Principal Investigator: $16,000 per year.

“Preliminary Global Outlook for Chemicals and Waste”; United Nations Environment Programme; 3/09 – 10/09; Principal Investigator; $52,751.

Support for the Fifth International Symposium on Nanotechnology, Occupational and Environmental Health; National Science Foundation; 6/11 – 7/12; Principal Investigator; $36,391.

Support for the Fifth International Symposium on Nanotechnology, Occupational and Environmental Health; National Institute for Occupational Safety and Health; 6/11 – 7/12; Principal Investigator; $19,500.

Contract to conduct field evaluations of nanotechnology manufacturing facilities; National Institute for Occupational Safety and Health; 10/11 – 9/13; Principal Investigator; $45,000.

“Assisting Auto Body and Repair Shops with Alternatives to Solvents,” EPA Region I, 10/12 – 9/14, Principal Investigator, $198,077.

“Particle Characterization Study of Carbon Black Manufacturing Work Environments,” subcontract to Purdue University, 8/13 – 7/15, Principal Investigator, $25,000.

"Toxics Use Reduction Institute"; Commonwealth of Massachusetts; 2003 – present; Director;1989 - 2003; Associate/Deputy Director (Acting Director, FY 1999); $432,000 in FY 1991, $1,000,000 in FY 1992, $1,466,000 in FY 1993, $1,466,000 in FY 1994, $1,466,000 in FY 1995, $1,766,000 in FY 1996, $1,766,000 in FY 1997, $1,766,000 in FY 1998, $1,766,000 in FY 1999; $1,766,000 in FY 2000; $1,766,000 in FY 2001; $1,717,000 in FY 2002; $1,717,000 in FY 2003; $1,632,000 in FY 2004; $1,100,00 in FY 2005; $1,200,00 in FY 2006; $1,324,000 in FY 2007; $1,667,000 in FY 2008; $1,667,000 in FY 2009; $1,333,000 in FY 2010; $1,667,000 in FY 2011; $1,667,000 in FY 2012; $1,667,000 in FY 2013; $1,667,000 in FY 2014; $1,667,000 in FY 2015; $1,667,000 in FY 2016; $1,667,000 in FY 2017; $1,667,000 in FY 2018; $1,667,000 in FY 2019 (Total: $47 million over 28 years).

**Publications**

**Journal Articles:**

1. Cooper, D.W., D.W. Underhill, and **M.J. Ellenbecker**, "A Critique of the U. S. Standard for Industrial Exposure to Sodium Hydroxide Aerosols," Am. Ind. Hyg. Assoc. J. 40(5):365 (1979).

2. Rudnick, S.N., and **M.J. Ellenbecker**, "The Role of Viscosity in Fabric Filtration," J. Air Poll. Control Assoc. 29(11):1161 (1979).

3. **Ellenbecker, M.J.**, and D. Leith, "Theory for Dust Deposit Retention in a Pulse-Jet Fabric Filter," Filtr. Sep. 16(6):624 (1979).

4. **Ellenbecker, M.J.**, and D. Leith, "Dust Deposit Profiles in a High Velocity Pulse-Jet Fabric Filter," J. Air Poll. Control Assoc. 29(12):1236 (1979).

5. **Ellenbecker, M.J.**, and D. Leith, "The Effect of Dust Retention on Pressure Drop in a High Velocity Pulse-Jet Fabric Filter," Powder Technology 25(2):147 (1980).bb

6. Leith, D., and **M.J. Ellenbecker**, "Theory for Pressure Drop in a Pulse-Jet Cleaned Fabric Filter," Atmospheric Environment 14:845 (1980).

7. Leith, D., and **M.J. Ellenbecker**, "Theory for Penetration in a Pulse-Jet Cleaned Fabric Filter," J. Air Poll. Control Assoc. 30(8):877 (1980).

8. **Ellenbecker, M.J.**, D. Leith and J. Price, "Impaction and Particle Bounce at High Stokes Numbers," J. Air Poll. Control Assoc. 30(11):1224 (1980).

9. **Ellenbecker, M.J.**, and D. Leith, "Dust Removal from Non-Woven Fabrics," Filtr. Sep. 18(4):316 (1981).

10. Butcher, S.S., and **M.J. Ellenbecker**, "Particulate Emission Factors for Small Wood and Coal Stoves," J. Air Poll. Control Assoc. 32(4):380 (1982).

11. Leith, D., and **M.J. Ellenbecker**, "Effect of Dust Size Distribution on the Collection Efficiency of Pulse-Jet Fabric Filters," J. Air Poll. Control Assoc. 32(7):740 (1982).

12. Leith, D., and **M.J. Ellenbecker**, "Dust Emission Characteristics of Pulse-Jet Cleaned Fabric Filters," Aerosol Sci. Technol. 1(4):401 (1982).

13. Leith, D, and **M.J. Ellenbecker**, "Dust Emissions from a Pulse-Jet Fabric Filter," Filtr. Sep. 20(4):311 (1983).

14. **Ellenbecker, M.J.**, and D. Leith, "Dust Removal Characteristics of Fabrics Used in Pulse-Jet Filters," Powder Technology 36:13 (1983).

15. **Ellenbecker, M.J.**, R.F. Gempel, and W.A. Burgess, "Capture Efficiency of Local Exhaust Ventilation Systems," Am. Ind. Hyg. Assoc. J. 44(10):752 (1983).

16. **Ellenbecker, M.J.**, "Evaluation of Total Airborne Emissions from Industrial Processes," J. Air Poll. Control Assoc. 33(9):884 (1983).

17. Flynn, M.R., and **M.J. Ellenbecker**, "The Potential Flow Solution for Air Flow into a Flanged Circular Hood," Am. Ind. Hyg. Assoc. J. 46(7):318 (1984).

18. Flynn, M.R., and **M.J. Ellenbecker**, "Capture Efficiency of Flanged Circular Local Exhaust Hoods," Annal. Occ. Hyg. 30(4):497-513 (1986).

19. Hammond, S.K., T.J. Smith, and **M.J. Ellenbecker**, "Determination of Occupational Exposure to Fabric Brightener Chemicals by HPLC," Am. Ind. Hyg. Assoc. J. 48(2):117-121 (1987).

20. Flynn, M.R., and **M.J. Ellenbecker**, "Empirical Validation of Theoretical Velocity Fields into Flanged Circular Hoods," Am. Ind. Hyg. Assoc. J. 48(4):380-389 (1987).

21. Herrick, R.F., T.J. Smith, and **M.J. Ellenbecker**, "Development of a Sampling and Analytical Method for Epoxy-Containing Aerosols: II. Application of the Method to Epoxy-Containing Aerosols," Am. Ind. Hyg. Assoc. J. 48(9):773-779 (1987).

22. Herrick, R.F., **M.J. Ellenbecker**, and T.J. Smith, "Measurement of the Epoxy Content of Paint Spray Aerosol: Three Case Studies," Appl. Ind. Hyg. 3(4):123-128 (1988).

23. Conroy, L.M., **M.J. Ellenbecker**, and M.R. Flynn, "Prediction and Measurement of Velocity into Flanged Slot Hoods," Am. Ind. Hyg. Assoc. J. 49(5):226-234 (1988).

24. **Ellenbecker, M.J.**, "Control of Worker Exposure," J. Public Health Policy 9(3):339-341 (1988).

25. Conroy, L.M., and **M.J. Ellenbecker**, "Capture Efficiency of Flanged Slot Hoods under the Influence of a Uniform Crossdraft: Model Development and Validation," Appl. Ind. Hyg. 4(6):135-142 (1989).

26. Brosseau, L.M., J.S. Evans, **M.J. Ellenbecker**, and M.L. Feldstein, "Collection Efficiency of Respirator Filters Challenged with Monodisperse Latex Particles," Am. Ind. Hyg. Assoc. J. 50(10):544-549 (1989).

27. Quinn, M.M., D.H. Wegman, I.A. Greaves, T.J. Lambert, S.K. Hammond, **M.J. Ellenbecker**, and R.F. Spark, "Male Sexual Dysfunction in a Group of Chemical Workers Manufacturing Stilbene Derivatives," Am. J. Ind. Med. 18(1):55-68 (1990).

28. Brosseau, L.M., **M.J. Ellenbecker**, and J.S. Evans, "Collection of Silica and Asbestos by Respirators at Steady and Cyclic Flow," Am. Ind. Hyg. Assoc. J. 51(8):420-26 (1990).

29. Rossi, M., **M.J. Ellenbecker**, and K. Geiser, "Techniques in Toxics Use Reduction: From Concept to Action," New Solutions 2(2):25-32 (1991).

30. Irwig, H.G., L.C. Oliver, T. Page, D.H. Wegman, and **M.J. Ellenbecker**, "Asbestos in Place: A Building Management Perspective," Ann. N. Y. Acad. Sciences 643:589-96 (1991).

31. **Ellenbecker, M.J.**, "Engineering Controls for Clean Air in the Office Environment," Chap. 2 in "Occupational Lung Diseases," G.R. Epler, ed., Clinics in Chest Medicine, 1992.

32. Brosseau, L.M., J.S. Evans, and **M.J. Ellenbecker**, "An Empirical Model for Estimating the Collection Efficiency of Dust-Mist Respirators," Annal. Occ. Hyg. 37:135-150 (1993).

33. Wenzl, T.B., D. Kriebel, E.A. Eisen, and **M.J. Ellenbecker**, "Comparisons between Magnetic Field Exposure Indices in an Automobile Transmission Plant," Am. Ind. Hyg. Assoc. J. 56(4):341-348 (1995).

34. Lee, B.K., **M.J. Ellenbecker**, and R. Moure-Eraso, "Potential Dioxin and Furan Sources from Hospital Solid Waste Streams: A Pilot Study," Korean Air Poll. Res. Assoc. J. 11(E):13-21 (1995).

35. **Ellenbecker, M.J.**, "Engineering Controls as an Intervention to Reduce Worker Exposure," Am. J. Ind. Med. 29:303-307 (1996).

36. Quinn, M.M., T.J. Smith, **M.J. Ellenbecker**, D.H. Wegman, E.A. Eisen, "Biologically-Based Indices of Fiber Exposure for Use in Epidemiology," Occ. Hyg. 3: 103-111 (1996).

37. Rimmer, T.W., and **M.J. Ellenbecker**, "Hearing Protector Attenuation Measurement by Bone Conduction Loudness Balance Compared with Real Ear Attenuation at Threshold in a Sound Field," Appl. Occup. Environ. Hyg. 12(1): 62-68 (1997).

38. Rimmer, T.W., and **M.J. Ellenbecker**, "Feasibility Assessment of a New Method for Measurement of Hearing Protector Attenuation: Bone Conduction Loudness Balance," Appl. Occup. Environ. Hyg. 12(1): 69-75 (1997).

39. Quinn, M.M., T.J. Smith, **M.J. Ellenbecker**, D.H. Wegman, E.A. Eisen, "A Model to Predict Deposition of Man Made Vitreous Fibers in the Human Tracheobronchial Region," Annals Occ. Hyg. 41(Suppl. 1): 197-202 (1997).

40. Lee, B.K., R. Moure-Eraso, M.J. Ginieres, R. Malloy, and **M. J. Ellenbecker**, "A Pilot Study of Air Emissions of Aldehydes Associated With the Processing of Recycled High Density Polyethylenes, " Korean Air Poll. Res. Assoc. J. 13 (E): 25-33(1997).

41. Lee, B.K., and **M.J. Ellenbecker**, "Effective Local Exhaust Ventilation on Cooking Fumes of Seasoned Meat," Envi. Sciences 2: 49-56 (1998).

42. Quinn, M.M., T.J. Smith, E.A. Eisen, D.W. Wegman, and **M.J. Ellenbecker**, "Implications of Different Fiber Measures for Epidemiologic Studies of Man-Made Vitreous Fibers," Am. J. Ind. Med. 38 (2): 132-139 (2000).

43. Louik, C., H. Frumkin, **M.J. Ellenbecker**, R.H. Goldman, M.W. Werler, and A.A. Mitchell, "Use of a Job-Exposure Matrix to Assess Occupational Exposures in Relation to Birth Defects," J. Occ. Env. Med. 42(7):693-703 (2000).

44. Roelofs, C., R. Moure, and **M.J. Ellenbecker**, "Pollution Prevention and the Work Environment: The Massachusetts Experience," Appl. Occup. Environ. Hyg. 15(11):843-850 (2000).

45. Veleva, V., and **M.J. Ellenbecker**, "A Proposal for Measuring Business Sustainability: Addressing Shortcomings in Existing Frameworks," Greener Mgmnt. Int. 31:101-120 (2000).

46. Veleva, V., and **M.J. Ellenbecker**, "Indicators of Sustainable Production: A New Tool for Promoting Business Sustainability," New Solutions 11(1):41-62 (2001).

47. Veleva, V., and **M.J. Ellenbecker**, "Indicators of Sustainable Production: Framework and Methodology," J. Cleaner Prod. 9(6):519-549 (2001).

48. Lee, B.K., and **M.J. Ellenbecker**, "Analyses of the Recycling Potential of Medical Plastic Wastes," Waste Management 22:461-470 (2002).

49. Roelofs, C., and **M.J. Ellenbecker**, "Results of the Massachusetts Methylene Chloride Users Survey," Appl. Occup. Environ. Hyg. 18(2):132-137 (2003).

50. Roelofs, C., E.M. Barbeau, **M.J. Ellenbecker**, and R. Moure, "Prevention Strategies in Industrial Hygiene: A Critical Literature Review," Am. Ind. Hyg. Assoc. J. 64(1):62-67 (2003).

51. Roelofs , C., and **M.J. Ellenbecker**, "Source Reduction for Prevention of Methylene Chloride Hazards: Case from Four Industrial Sectors," Environmental Health: A Global Access Science Source 2(9): (2003).

52. Lee, B.K., **M.J. Ellenbecker**, and R. Moure-Eraso, "Alternatives for Treatment and Disposal Cost Reduction of Regulated Medical Wastes," Waste Management 24(2): 143-51 (2004).

53. Bello, D., S. R. Woskie, R.P. Streicher, Y. Liu, M.H. Stowe, E. Eisen, **M. J. Ellenbecker**, J. Sparer, F. Youngs, M. Cullen, C.A. Redlich, "Polyisocyanates in Occupational Environments: A Critical Review of Metrics and Standards," Am. J. Ind. Med.,46(5): 480-91 (2004).

54. Kalil, A.J., S.W. Woskie, C. Holcroft, **M.J. Ellenbecker**, and B. Buchholz, "Time Variant Exposure Analysis (TVEA): A Measurement Tool for Characterizing Particulate Exposure Determinants in Construction," J. Occup. Environ. Hyg. 1(12):816-25 (2004).

55. McKernan, J. L., **M. J. Ellenbecker**, C. Holcroft, "Evaluation of a Proposed Velocity Equation for Exothermic Process Control," Annals Occ. Hyg. doi: 10.1093/annhyg/mem006 (2007).

56. McKernan, J. L., **M. J. Ellenbecker**, C. Holcroft, M. R. Petersen, "Evaluation of a Proposed Area Equation for Improved Exothermic Process Control," Annals Occ. Hyg. doi: 10.1093/annhyg/mem053 (2007).

57. Massawe, E., K. Geiser, **M. J. Ellenbecker**, and J. Marshall, "Health, Safety and Ecological Implications of Biobased Floor Stripping Products," J. Env. Health 69(9): 45-52 (2007).

58. McKernan, J. L., and **M. J. Ellenbecker**, "Ventilation Equations for Improved Exothermic Process Control," Annals Occ. Hyg. doi: 10.1093/annhyg/mem016 (2007).

59. Massawe, E., K. Geiser, **M. J. Ellenbecker**, and J. Marshall, "Technical Performance Evaluation of Potential Biobased Floor Strippers," J. Cleaner Prod. 16(1): 12-21(http://dx.doi.org/10.1016/j.jclepro.2006.05.014) (2008).

60. Bello, D., A.J. Hart, K. Ahn, M. Hallock, N. Yamamoto, E. Garcia, **M.J. Ellenbecker**, and B.L. Wardle, "Exposure to Nanoscale Particles during CVD Growth and Subsequent Handling of Vertically-aligned Carbon Nanotube Films," Carbon 46(6): 974-981 (2008).

61. Tsai., S., A. Ashter, E. Ada, J. Mead, C. Barry, and **M. J. Ellenbecker**, "Airborne Nanoparticle Release Associated with the Compounding of Nanocomposites using Nanoalumina as Fillers," Aerosol and Air Quality Research 8(2): 160-177 (2008).

62. Tsai. S., E. Ada, J. Isaacs, and **M.J. Ellenbecker**, "Airborne Nanoparticle Exposures Associated with the Manual Handling of Nanoalumina in Fume Hoods," J. Nanoparticle Res. doi: 10.1007/s1 1051-008-9459-z (2008), 11(1): 147.

63. Ahn, K., **M. J. Ellenbecker**, S. R. Woskie, and L. J. DiBerardinis, "A Review of Quantitative Experimental Studies on Factors Affecting Laboratory Fume Hood Performance and Its Related Factors," J. Occup. Environ. Hyg. 5(11):735-54 (2008).

64. Tsai., S., A. Ashter, E. Ada, J. Mead, C. Barry, and **M. J. Ellenbecker**, "Control of Airborne Nanoparticle Release during Compounding of Polymer Nanocomposites," NANO 3(4):1-9 (2008).

65. Shepherd, S., Woskie, S. R., Holcroft, C. and **M.J. Ellenbecker**, "Reducing Silica and Dust Exposures in Construction During Use of Powered Concrete-Cutting Hand Tools: Efficacy of Local Exhaust Ventilation on Hammer Drills, "J. Occup. Environ. Hyg. 6(1):42-51 (2009).

66. Bello D., M. Hallock, K. Ahn, N. Yamamoto, E. Garcia, **M.J. Ellenbecker**, A.J. Hart, B.L. Wardle, "Exposure to Nanoscale Particles and Fibers during Fabrication and Machining of Hybrid Advanced Composites Containing Carbon Nanotubes," J. Nanoparticle Res. 11(1):231-249 (2009).

67. Tsai, S., M. Hofmann, M. Hallock, E. Ada, J. Kong, and **M. Ellenbecker**, "Characterization and Evaluation of Nanoparticle Release during the Synthesis of Single-walled and Multi-walled Carbon Nanotubes by Chemical Vapor Deposition, Env. Sci. Technol. 43(15): 6017-23 (2009) DOI: 10.1021/es900486y (2009).

68. Morose, G., R. Farrell, S. Shina, **M. Ellenbecker**, and R. Moure-Eraso, "Evaluation of Lead-free Solders, Halogen-free Laminates, and Nanomaterial Surface Finishes for

Assembly of Printed Circuit Boards for High Reliability Applications," J. Surf. Mount Tech. 22(4): 13-21 (2009).

69. Ashter, A., S. Tsai, Lee, J.S., **M. J. Ellenbecker**, J. Mead, and C. Barry, "Effects of Nanoparticle Feed Location during Nanocomposite Compounding," Polymer Eng. Sci. J. 50(1): 154-64 (2009).

70. Tsai, S., R.F. Huang, and **M. J. Ellenbecker**, "Airborne Nanoparticle Exposures while Using Conventional, Constant Velocity and Air-Curtain Isolated Hoods," Ann. Occ. Hyg., DOI:10.1093/annhyg/mep074, 54(1): 78-87 (2010).

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72. **Ellenbecker, M.J.**, and K. Geiser, "At the Source: the Origins of the Massachusetts Toxics Use Reduction Program and an Overview of this Special Issue," published on-line, J. Cleaner Prod., doi: 10.1016/j.clepro.2010.10.004, 19(5): 389-96 (2011).

73. **Ellenbecker, M.J.**, and S. Tsai, "Engineered Nanoparticles: Safer Substitutes for Toxic Materials, or a New Hazard?," published on-line, J. Cleaner Prod., doi: 10.1016/j.clepro.2010.10.018, 19(5): 483-7 (2011).

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112. Tsai, S., **Ellenbecker, M.**, "The Next Phase of Occupational and Environmental Exposure and Control Strategies for Nanotechnology", 5th International Symposium on Nanotechnology, Occupational and Environmental Health (NanOEH2011), Boston, MA, August 2011.

113. Tsai, S., Echevarría-Vega, M., Sotiriou, G., Huang, C., Schmidt, D., Santeufemio, C., Demokritou, P., **Ellenbecker, M.**, "Engineering Control Technique for Nano-Industry-Filtration Technology for Engineered Nanoparticles", 5th International Symposium on Nanotechnology, Occupational and Environmental Health (NanOEH2011), Boston, MA, August 2011.

114. Huang, C., Tsai, S., Dunn, K., **Ellenbecker, M.**, "Characterization of Airborne Nanoparticles and Salt Aerosols Loss in Sampling Tubing", 5th International Symposium on Nanotechnology, Occupational and Environmental Health (NanOEH2011), Boston, MA, August 2011.

115. Dunn, K., Tsai, S., Huang, C., **Ellenbecker, M.**, "Evaluation of Fume Hood Performance using Computational Fluid Dynamics", 5th International Symposium on Nanotechnology, Occupational and Environmental Health (NanOEH2011), Boston, MA, August 2011.

116. Dunn, K., Tsai, S., Woskie, S., Bennet, J., **Ellenbecker, M.**, "Evaluation of Nanoparticle Dispersion and Containment of a New Nanomaterial Fume Hood using

Computational Fluid Dynamics", American Industrial Hygiene Conference & Expo (AIHCE), Indianapolis, IN, June 2012.

117. **Ellenbecker, M**., Tsai, S., Dunn, K., "Methods to evaluate the effectiveness of nanoparticle control strategies", Conference on Nanotechnology and Sustainability, Washington DC, November 2012.

118. **Ellenbecker, M**., Tsai, S., "Research into the evaluation and control of airborne ENP exposures", NSF NSEC Grantees Conference, Washington, DC, December 2012.

119. Dunn, K., Tsai, S.,Woskie, S., Bennett, J., Garcia, A., **Ellenbecker, M.**, "Use of Tracer Gas and Nanoparticle methods to Evaluate a New Nano Containment Hood", presented at the 6th International Symposium on Nanotechnology, Occupational and Environmental Health (NanOEH2013), Nagoya, Japan, October 2013.

120. Tsai, S**., Ellenbecker, M.**, "Characterization of airborne nanoparticle loss in sampling tubing", presented at the 6th International Symposium on Nanotechnology, Occupational and Environmental Health (NanOEH2013), Nagoya, Japan, October 2013.

121. Dunn, K., Tsai, S., Bennett, J.S., Woskie, S.R., **Ellenbecker, M**., "Using computational fluid dynamics to assess the impact of the user on nanoparticle containment for traditional and nano fume hoods," American Industrial Hygiene Conference & Expo (AIHCE), San Antonio, TX, June 2014.

122. **Ellenbecker, M**., "Controlling exposures to engineered nanoparticles using exposure prevention and minimization," American Industrial Hygiene Conference & Expo (AIHCE), San Antonio, TX, June 2014.

123. **Ellenbecker, M.**, "The Challenge of Setting Occupational Exposure Limits for Engineered Nanomaterials," the Henry F. Smyth, Jr., Award Lecture, American Industrial Hygiene Conference & Expo (AIHCE), Baltimore, MD, May 2016.

124. **Ellenbecker, M.**, "ACGIH® and the Development and Use of TLVs®," Advanced Surface Engineering Technologies for a Sustainable Defense, Virtual Workshop, August, 2020.

**Technical Reports, Critiques, etc.:**

1. Kohlberg, I., H. Gelman, and **M.J. Ellenbecker**, "Status and Technical Considerations of AWACS EMP Program," Report No. MTR-2889, The Mitre Corporation, Bedford, MA, August, 1974.

2. Cooper, D.W., D.W. Underhill, and **M.J. Ellenbecker**, "A Critical Review of Sodium Hydroxide Aerosol Toxicity," Final Report, NRC Contract AT(49-24)-0300, Harvard School of Public Health, Boston, December, 1977.

3. Leith, D., **M.J. Ellenbecker**, M.W. First, J.M. Price, K.P. Martin, and D.G. Gibson, "Performance of a High-Velocity Pulse-Jet Filter, II," EPA Report No. EPA-600/7-80-042, Industrial Environmental Research Laboratory, Research Triangle Park, NC 27711, March, 1980.

4. Leith, D., **M.J. Ellenbecker**, J.D. Spengler, P. Fairchild, and J.D. Sarsfield, "Assessment of Pollutant Monitoring Technologies," OTA Contract 033-3540.0, Leith Environmental Research Corporation, Newton, MA, November 10, 1980.

5. Leith, D., **M.J. Ellenbecker**, and M.W. First, Performance of a High-Velocity Pulse-Jet Filter, III, EPA Report No. EPA-600/7-81-027, Industrial Environmental Research Laboratory, Research Triangle Park, NC 27711, March 1981.

6. **Ellenbecker. M.J.**, D.H. Wegman, and M.M. Quinn,"Health Hazard Evaluation Report, Seth Thomas Division, General Time Corporation," NIOSH Report No. HETA 82-044-1284, Robert A. Taft Laboratories, Cincinnati, OH 45226, March 1983.

7. Wegman D.H., **M.J. Ellenbecker**, M.M. Quinn, An Evaluation of Male Reproductive Hazards in a Chemical Operation, Health Hazard Evaluation Report, National Institute for Occupational Safety and Health, submitted June 1982.

8. Treitman, R.D., J.D. Spengler, **M.J. Ellenbecker**, D. Frankel, C. Kolb, K. Howe, "Workshop on Evaluation of Monitoring Equipment for Personal Exposure Assessment - A Summary Report," Physical Sciences and Engineering Program, Department of Environmental Sciences and Physiology, School of Public Health, Harvard University, Boston, MA, December, 1983.

9. Baker, E.L., and **M.J. Ellenbecker**, "Health Hazard Evaluation Report, Energy Resources Co., Inc.," NIOSH Report No. HETA 81-382-1439, Robert A. Taft Laboratories, Cincinnati, OH 45226, March, 1984.

10. Brosseau, L.M., and **M.J. Ellenbecker**, "Comments on A Comparative Analysis of Flow Rates on the Outcome of Fiber Counts in Asbestos Sampling," App. Ind. Hyg. 3(6):195 (1988).

11. **Ellenbecker, M.J.**, "Introduction: Engineering Solutions to Improve the Environment," New Solutions 2(2):25 (1991).

12. Quinn, M.M., T.J. Smith, **M.J. Ellenbecker**, D.H. Wegman, E.A. Eisen, "Exposure Assessment for Airborne Man-Made Mineral Fibres - Some Comments," Ann. Occ. Hyg. 38(6):959-961 (1994).

13. Thomas, K.B., and **M.J. Ellenbecker**, "Evaluation of Alternatives to Chlorinated Solvents for Metal Cleaning," Environmental Protection Agency, Report No. EPA/600/R-97/032, National Risk Management Research Laboratory, Cincinnati, OH, March 1997.

14. Becker, M., **M.J. Ellenbecker**, E. Harriman, J. Jankauskas, C. LeBlanc, J. Siegel, K.B. Thomas, "Toxics Use Reduction Institute Research Program - 1990-1997," Toxics Use Reduction Institute, University of Massachusetts Lowell, February, 1997.

15. Wages, R., S. Markowitz, S. Kieding, M. Griffon, **M.J. Ellenbecker**, E. Averill Samaras, "Former Worker Medical Surveillance Program at Department of Energy Gaseous Diffusion Plants, Phase I: Needs Assessment," Oil, Chemical and Atomic Workers International Union, October 1, 1997.

16. Quinn, M.M., and **M.J. Ellenbecker**, "Report on Community Health and Safety Related to the Still Water Design Proposal to Locate at the Fitzgerald Shipyard, Chelsea, MA," November 30, 2000.

17. Fraser, M.E., J. Clark, **M.J. Ellenbecker**, K. Ahn, M. Noah, R. Petrain, M. Magoun, "Small Business Safety Officer," Final Report, National Institute for Occupational Safety and Health, Small Business Innovation Research Program, Grant No. 1 R43 OH04183-01, July 2, 2001.

18. Roelofs, C., **M.J. Ellenbecker**, "Furniture Strippers Need to Adopt a Pollution Prevention Approach," Am. Ind. Hyg. Assoc. J. 63(6):676 (2002).

19. Roelofs, C., **M.J. Ellenbecker**, "Calculating the Benefits of Regulation," Science 300(5624):1372 (2003).

20. **Ellenbecker, M.J.**, et al., "Five Chemicals Alternatives Assessment Study," Toxics Use Reduction Institute, June 2006.

21. **Ellenbecker, M.J.**, "Interim Best Practices for Working with Nanoparticles, Center for High-rate Nanomanufacturing," Version 0, December 2007.

22. **Ellenbecker, M.J.**, and S. Tsai, "Interim Best Practices for Working with Nanoparticles, Center for High-rate Nanomanufacturing," Version 1, November 2008.

23. **Ellenbecker, M.J.**, "The Future of Occupational Hygiene Education and Research," Commentary, J. Occ. Env. Hyg. 9: D172 – 4, 2012.

24. **Ellenbecker, M.J.**, and Tsai, S., "General Safe Practices for Working with Engineered Nanomaterials in Research Laboratories," DHHS (NIOSH) Publication Number 2012-147, http://www.cdc.gov/niosh/docs/2012-147/, 2012.

25. Jacobs, M.M., **Ellenbecker, M.J.**, Hoppin, P., Kriebel, D., and Tickner, J., "Precarious Promise: A Case Study of Engineered Carbon Nanotubes," Lowell Center for Sustainable Production, March 2014.

**Invited Lectures:**

Lectures on Industrial Hygiene Control Methods, The Institute of Health, Chinese Academy of Medical Sciences, Beijing, and The Shanghai First Medical College, Shanghai, June-July, 1983.

"Capture Efficiency of Local Exhaust Hoods," the 5th Annual Richard B. McKnight Memorial Lecture, given at the 30th Annual Industrial Ventilation Conference, North Carolina State University, Raleigh, April 22, 1988.

"Ventilation for Controlling Exposure to Airborne Fibers," ILO Workshop on Preventive Measures and Controlled Use of Mineral and Synthetic Fibers, Sao Paulo, Brazil, May, 1994.

"Toxics Use Reduction," one-week course, Universidad de Sonora, Hermosillo, Mexico, March, 1999, and November-December, 2002.

"Influence of Airflow Obstructions and Limiting Surfaces on Local Exhaust Performance," International Seminar on Specially Engineered Local Exhausts and Intelligent Exhaust Systems, Zurich, Switzerland, March 21, 2003.

"Occupational Health Implications When Working with Engineered Nanoparticles," keynote address at the Annual Meeting of the Taiwan Industrial Hygiene and Occupational and Environmental Medicine Societies, Taichung, Taiwan, April 2009.

**Dissertation:**

Pressure Drop in a Pulse-Jet Fabric Filter, Department of Environmental Health Sciences, Harvard School of Public Health, Boston, MA, 02115, 1979.

**Doctoral Dissertations Supervised:**

1. Flynn, M.R., "The Capture Efficiency of Local Exhaust Hoods." Harvard School of Public Health, 1986.

2. Conroy, L.M., "Capture Efficiency of Flanged Slot Hoods," Harvard School of Public Health, 1988.

3. Quinn, M.M., "A Biologically-Based Quantitative Method for Characterizing Airborne Fiber Exposure," University of Massachusetts Lowell, 1992.

4. Law, P.L., "A Model for the Prioritization of Toxic Chemicals: Chemical Toxicity, Chemical Atmospheric Fate, Population and Worker Exposures and Ranking Factors," University of Massachusetts Lowell, 1993.

5. Clement, R.S., "Performance Testing of Portable Radiation Detection Instrumentation," University of Massachusetts Lowell, 1994.

6. Rimmer, T.W., "A New Method for Measurement of Hearing Protector Attenuation: Bone Conduction Loudness Balance," University of Massachusetts Lowell, 1995.

7. Lee, B.K., "A Study of the Characterization, Disposal, Recycling, and Air Emissions of Medical and Plastic Wastes," University of Massachusetts Lowell, 1996.

8. Naderi, S., "Integrated Ozone Index (IOI): A Statistical Criterion for Effects, Trends and Attainment," University of Massachusetts Lowell, 1998.

9. Choi, M.H. "A Quantitative Evaluation Method for the Promotion of Cleaner Production using Non-Chlorinated Cleaning Alternatives in Electroplating Job Shops," University of Massachusetts Lowell, 1999.

10. Veleva, V.R., "Developing Indicators of Sustainable Production," University of Massachusetts Lowell, 2001.

11. Roelofs, C.R., "Losing Controls: The Case for a Preventive Industrial Hygiene," University of Massachusetts Lowell, 2001.

12. Ahn, K., "Laboratory Fume Hood Performance," University of Massachusetts Lowell, 2003.

13. Osiri, P., "Theoretical and Experimental Determination of Minimum Transport Velocities in Industrial Ventilation," 2004.

14. McKernan, J., "Development and Evaluation of Proposed Equations for Improved Exothermic Process Control," 2006.

15. Tsai, S., "Exposure Assessment for Handling and Processing Nanoparticles in University Laboratories," 2008.

16. Morose, G., "Electronics Assembly, Rework, and Reliability Evaluation Using Lead-free Soldering Materials, Halogen-free Laminate Materials, and Surface Finishes with Nanomaterials," 2008.

**Consulting Activities**
**Selected Clients:**

Hunter Environmental Sciences
The Polaroid Corporation
Bolt, Beranek and Newman
The Congressional Office of Technology Assessment
Norfolk County Hospital
Digital Equipment Corporation
Energy Resources Corporation
W. L. Gore
Portsmouth Naval Shipyard
Channing L. Bete
Environmental Protection Agency
Rutgers University
BGI Incorporated
Metcalf & Eddy
Boston University
Epidemiology Resources Inc.
New England Electric
Wheelabrator-Frye
U. S. Department of Labor
Federal Trade Commission
General Electric Co.
Bewick Associates
GTE Sylvania
Beacon Management
Energy Systems Research Group, Inc.

**Activities:**

Ventilation system design and evaluation.

Comprehensive industrial hygiene surveys, including sampling for many air contaminants (e.g., asbestos, respirable dust, organic vapors, welding fumes).

Evaluation of possible asbestos and other hazardous exposures and control measures for pending litigation cases.

# Depositions Given - 1994-2020

## Michael J. Ellenbecker, Sc.D., CIH

| Date | Case | My Client |
|---|---|---|
| 10/14/20 | Bridgewater case | Maune, Raichle |
| 10/2/20 | Phalen case | Satterley & Kelley |
| 9/29/20 | Sarkis case | Shepard Law |
| 9/23/20 | Kozlow case | Maune, Raichle |
| 9/22/20 | Reyes case | Kazan |
| 9/15/20, 10/29/20 | Maust case | Maune, Raichle |
| 9/3/20 | Dena case | Maune, Raichle |
| 9/1/20 | Lewis deposition | Maune, Raichle |
| 7/22/20 | Fenstermacher case | Maune, Raichle |
| 7/16/20 | Maki case | Satterley & Kelley |
| 6/23/20 | Cox case | Maune, Raichle |
| 3/30/20 | Wilgenbusch case | Maune, Raichle |
| 3/10/20 | Myers case | Satterley & Kelley |
| 2/20/20 | Daily case | Maune, Raichle |
| 2/17/20 | Grubelic case | Maune, Raichle |
| 1/27/20 | Brazil case | Maune, Raichle |
| 1/21/20 | Connaughton case | Maune, Raichle |
| 12/30/19 | Roy case | Maune, Raichle |
| 12/17/19 | Levesque case | Maune, Raichle |
| 11/4/19 | Lara case | Maune, Raichle |
| 10/1/19 | Corrigan case | Shepard Law |
| 9/25-26, 10/28/19 | Wiman case | Satterley & Kelley |
| 9/11/19 | Johnson case | Thornton Law Firm |
| 8/13/19 | Lewis case | Motley Rice |
| 7/23/19 | McLauchlen case | Maune, Raichle |

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| 6/19/19 | Cornelius case | Bern Cappelli |
| 6/14/19 | Hinkle case | Bern, Cappelli |
| 5/15/19 | Richardson case | Bern, Cappelli |
| 4/25/19 | Maguire case | Eichen Crutchlow |
| 4/1/19 | Solomon case | Shepard Law |
| 3/18/19 | Hogue case | Maune, Raichle |
| 3/11/19 | Mason case | Bern, Cappelli |
| 3/8/19 | Collyer case | Satterley & Kelley |
| 3/5/19 | Auen case | Kazan, McClain |
| 11/12/18 | Mitchell case | Bern, Cappelli |
| 11/6/18 | Beach case | Maune, Raichle |
| 10/22/18 | Crossland and Holland cases | Murphy, Falcon & Murphy |
| 10/9/18 | Butchko case | Maune, Raichle |
| 9/28/18 | Collins case | Bern Cappelli |
| 9/27/18 | York case | Bern Cappelli |
| 9/26/18 | DeForge case | Bern Cappelli |
| 9/24/18 | Watts case | Maune, Raichle |
| 9/21/18 | Reyes case | Kazan, McClain |
| 8/29/18 | Martin case | Shepard Law Firm |
| 8/24/18 | Barr case | Maune, Raichle |
| 8/23/18 | Young case | Kazan, McClain |
| 8/13/18 | Long case | Maune, Raichle |
| 7/12/18 | Summerlin case | Shepard Law Firm |
| 4/23/18 | Granger case | Sinas, Dramis |
| 4/9/18 | Derrah case | Shepard Law Firm |
| 4/6/18 | Sontag case | Maune, Raichle |
| 4/2/18 | Jones case | Maune, Raichle |
| 3/23/18 | Cleghorn case | Thornton Law Firm |
| 3/19/18 | MacIntyre case | Thornton Law Firm |
| 2/2/18 | Bolin case | Satterley & Kelley |

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| 1/29/18 | Dennis case | Maune, Raichle |
| 12/11/17 | Moore case | Satterley & Kelley |
| 12//5/17 | Logan case | Kazan, McClain |
| 11/28/17 | Sherwin case | Thornton Law Firm |
| 11/14/17 | Rudolph case | Kazan, McClain |
| 10/17/17 | Williams case | Satterley & Kelley |
| 9/18/17 | Serrano case | Maune, Raichle |
| 8/21/17 | Booker case | Kazan, McClain |
| 5/9/17 | Steven Sheets case | Satterley & Kelley |
| 4/25/17 | Shaw case | Maune, Raichle |
| 4/11/17 | Esposito case | Eichen Crutchlow |
| 3/30/17 | Sylvestre case | Thornton Firm |
| 3/17/17 | Foster case | Maune, Raichle |
| 3/10/17, 12/11/17 | Moore case | Satterley & Kelley |
| 3/8/17, 3/14/17 | Marshall case | Kazan, McClain |
| 3/6/17 | Ballard case | Maune, Raichle |
| 3/23/17 | Zampa case | Kazan, McClain |
| 2/21/17 | Lennon case | Maune, Raichle |
| 2/14/17 | Lindell case | Thornton Firm |
| 2/10/17 | Collins v. 3M | Friedman & Rubin |
| 2/2/17 | Herbert Sheets case | Satterley & Kelley |
| 1/20/17 | Clark case | Maune, Raichle |
| 12/27/16 | Parbury case | Maune, Raichle |
| 12/22/16 | Champagne case | Maune, Raichle |
| 12/6/16 | Espinosa case | Kazan, McClain |
| 12/4/16 | Beal case | Maune, Raichle |
| 10/20/16 | Auen case | Kazan, McClain |
| 10/18/16 | Olson case | Kazan, McClain |
| 10/14/16 | Horton case | Maune, Raichle |

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| 10/8/16 | Moody case | Maune, Raichle |
| 8/9/16 | Soto case | Maune, Raichle |
| 5/31/16 | Page case | Thornton Law Firm |
| 3/11/16 | Mead case | Maune, Raichle |
| 3/9/16 | Tyler case | Kazan, McClain |
| 2/19/16 | Webber case | Kazan, McClain |
| 2/8/16 | Shea case | Kazan, McClain |
| 1/28/16 | Dickerson case | Maune, Raichle |
| 1/21/16 | Lemberger case | Maune, Raichle |
| 1/7/16 | Mitchem case | Maune, Raichle |
| 12/23/15 | Vega case | Maune, Raichle |
| 11/17/15 | Ortwein case | Kazan, McClain |
| 8/27/15 | Grimsley case | Maune, Raichle |
| 8/21/15 | Emerson case | Kazan, McClain |
| 8/20/15 | Trejo case | Kazan, McClain |
| 8/6/15 | White case | Satterley & Kelley |
| 6/2/15 | Solarzano case | Kazan, McClain |
| 5/27/15 | Gilvin case | Levy, Konigsburg |
| 2/11/15 | Boyd case | Kazan, McClain |
| 11/12/14 | Perez case | Kazan, McClain |
| 10/16/14 | Collins case | Kazan, McClain |
| 6/12/14 | Clark and Sheller cases | Motley, Rice |
| 6/6/14 | Koepke case | Kazan, McClain |
| 4/18/14 | Neff case | Motley, Rice |
| 4/10/14 | Strouse case | Kazan, McClain |
| 4/9/14 | Newman case | Maune, Raichle |
| 3/21/14 | Parga case | Kazan, McClain |
| 2/28/14 | Mirto case | Michael Serling |
| 1/27/14 | Kucich case | Kazan, McClain |
| 9/30/13 | Rosenberger and Arnett cases | Motley, Rice |

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| 7/25/13 | Bland case | Kazan, McClain |
| 7/8/13 | Nelson case | Kazan, McClain |
| 5/15/13 | Farrell case | Jacobs & Crumplar |
| 3/8/13 | Alley case | Robert Peirce & Associates |
| 3/1/13 | Grigg case | Kazan, McClain |
| 9/27/12 | Manser case | Thornton & Naumes |
| 9/4/12 | CSX v. Peirce Associates | DeForest, Koselnik |
| 6/5/12 | West Virginia asbestos cases | Goldberg, Persky<br>Motley, Rice |
| 5/18/12 | Square D cases | Jacobs & Crumplar |
| 4/5/12 | Dye case | Porter & Malouf |
| 2/2/12 | West Virginia asbestos cases | Goldberg, Persky<br>Motley, Rice |
| 11/18/11 | Bezanson case | Thornton & Naumes |
| 11/17/11 | Diane Taylor case | Motley, Rice |
| 10/13/11 | West Virginia asbestos cases | Goldberg, Persky<br>Motley, Rice |
| 9/30/11 | McGuire case | George & Sipes |
| 7/27/11 | Various Delaware asbestos cases | Jacobs & Crumplar |
| 7/7/11 | Wade case | Motley, Rice |
| 6/20,7/5/11 | Stillman case | Sales, Tillman, Wallbaum, Catlett & Satterley |
| 5/27/11 | West Virginia asbestos cases | Goldberg, Persky<br>Motley, Rice |
| 1/27-28/11 | West Virginia asbestos cases | Goldberg, Persky<br>Motley, Rice<br>Hartley & O'Brien |
| 11/5/10 | MacDonald case | Motley, Rice |
| 11/5/10 | Beard & Oaks cases | Porter & Malouf |
| 10/15/10 | West Virginia asbestos cases | Goldberg, Persky<br>Motley, Rice |
| 10/12/10 | Bankhead v. Ford Motor Co. et al. | Sales, Tillman, Wallbaum, Catlett & Satterley |

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| 9/13/10 | Nevamar cases | Rosenthal & Levy |
| 9/9/10 | Cohan & Wirwicz cases | Thornton & Naumes |
| 7/9/10 | Jelks v. Florida East Coast RR | Cook, Hall and Lampros |
| 6/11/10 | Armbister & Sammons v. Norfolk Southern | Motley, Rice |
| 6/1/10 | Huelsman v. CSX | Sales, Tillman, Wallbaum, Catlett & Satterley |
| 6/1/10 | McCauley v. Louiseville Gas & Electric | Sales, Tillman, Wallbaum, Catlett & Satterley |
| 5/20/10, 5/21/10 | West Virginia asbestos cases | Goldberg, Persky Motley, Rice |
| 2/28/10 | Conrad Rock case | Thornton & Naumes |
| 1/28/10 | West Virginia asbestos cases | Goldberg, Persky Motley, Rice |
| 1/18/10 | Quillen v. Safety Kleen | Sales, Tillman, Wallbaum, Catlett & Satterley |
| 1/15/10 | Various Delaware asbestos cases | Jacobs & Crumplar |
| 1/12/10 | Farmer v. Illinois Central RR | Gavin |
| 12/23/09, 4/30/10 | Jacksonville FAA cases | Pajcic & Pajcic |
| 10/8/09 | West Virginia asbestos cases | Goldberg, Persky Motley, Rice |
| 9/3/09 | Chapman v. CSX | Goldberg, Persky |
| 9/3/09 | Lone v, CSX | Sales, Tillman, Wallbaum, Catlett & Satterley |
| 8/17/09 | Various Delaware asbestos cases | Jacobs & Crumplar |
| 7/13/09, 7/21/09 | Rehm case | Sales, Tillman, Wallbaum, Catlett & Satterley |
| 5/29/09 | West Virginia asbestos cases | Goldberg, Persky Motley, Rice |
| 5/21/09 | Various Delaware asbestos cases | Jacobs & Crumplar |
| 5/8/09 | CSX v. Peirce & Associates | DeForest Koscelnik Yokitis Kaplan & Berardinelli |
| 12/17/08 | Frank v. Illinois Central RR | Gavin |
| 12/15/08 | Galbreath v. Norfolk Southern | Robert Peirce & Associates |

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| 10/10/08 | Howell case | George & Sipes |
| 10/1/08 | West Virginia asbestos cases | Goldberg, Persky<br>Motley, Rice |
| 9/17/08 | Cofer v. Abex Corp. et al. | Motley, Rice |
| 7/29/08 | DeRobertis v. New Jersey Transit | George Kachmar |
| 7/10/08 | Lee v. CSX | Law Offices of William S. Guy |
| 4/18/08 | West Virginia asbestos cases | Goldberg, Persky<br>Motley, Rice |
| 3/27/08 | Rome v. Abex | Gavin Law Firm |
| 3/21/08 | Long v. CSX | Sales, Tillman, Wallbaum & Satterley |
| 2/19/08 | Loudermilk v. CSX | Motley, Rice |
| 1/4/08 | West Virginia asbestos cases | Goldberg, Persky<br>Motley, Rice |
| 12/20/07 | White v. CSX | Sales, Tillman, Wallbaum & Satterley |
| 10/19/07 | Delaware asbestos cases | Jacobs & Crumplar |
| 10/12/07 | Elbrink v. Alcoa, et al. | George & Sipes |
| 9/25/07 | Blackburn v. Illinois Central | Gavin Law Firm |
| 9/13/07 | Postlewaite v. CSX | Sales, Tillman, Wallbaum & Satterley |
| 9/12/07 | West Virginia asbestos cases | Goldberg, Persky<br>Motley, Rice |
| 8/2/07 | Ross v. BNSF | Lee, Smart, Cook, Martin & Patterson |
| 7/17/07 | Thomas v. CSX & Blocker v. CSX | Sales, Tillman, Wallbaum & Satterley |
| 6/21/07 | Demers case | Thornton & Naumes |
| 6/19/07 | Kennedy v. Illinois Central | Law Offices of William S. Guy |
| 5/7/07 | West Virginia asbestos cases | Goldberg, Persky<br>Motley, Rice |
| 4/26/07 | Hadley v. Union Pacific | Robert Peirce & Associates |

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| 4/17/07 | Holmes v. American Standard | Environmental Attorneys Group |
| 3/29/07 | Various Delaware asbestos cases | Jacobs & Crumplar |
| 1/25/07 | West v. BNSF | Richard Dinsmore |
| 12/21/06 | Riggs & Thompson v. CSX | Sales, Tillman, Wallbaum & Satterley |
| 9/21/06 | Stigliano & Walker Delaware asbestos cases | Jacobs & Crumplar |
| 8/29/06 | West Virginia asbestos cases | Goldberg, Persky Motley, Rice |
| 8/21/06 | Farnsworth v. CSX | Robert Peirce & Associates |
| 8/11/06 | Galloway v. Union Pacific | Schlichter, Bogard & Denton |
| 8/1/06 | Black v. C&O RR | Motley, Rice |
| 7/18/06 | Terry Williams v. CSX | Sales, Tillman, Wallbaum & Satterley |
| 7/13/06 | Blackburn v. Illinois Central | Gavin Law Firm |
| 5/17/06 | West Virginia asbestos cases | Goldberg, Persky Motley, Rice |
| 5/9/06 | Hyatt et al. v. Illinois Central | Gavin Law Firm |
| 4/4/06 | Robinson v. Conrail | Peirce, Raimond & Coulter |
| 3/23/06 | Various Delaware asbestos cases | Jacobs & Crumplar |
| 2/27/06 | Various Delaware asbestos cases | Jacobs & Crumplar |
| 1/20/06 | West Virginia asbestos cases | Goldberg, Persky Motley, Rice |
| 1/9/06 | Carney, et ux v. Anchor Packing, et al. | Hulsey Litigation Group |
| 1/5/06 | Blackburn, et al. v. Illinois Central | Gavin Law Firm |
| 12/15/05 | Hensley v. CSX | Sales, Tillman, Wallbaum & Satterley |
| 12/4/05 | Hayes v. CSX | Sales, Tillman, Wallbaum & Satterley |
| 12/1/05 | Curry v. Amtrak | Sales, Tillman, Wallbaum & Satterley |

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| 11/28/05 | Cohen v. Hampden Automotive Sales | Thornton & Naumes |
| 10/27/05 | Black v. CSX | Mark Coulter |
| 10/13/05 | Johnson v. CSX | Sales, Tillman, Wallbaum & Satterley |
| 9/7/05 | West Virginia asbestos cases | Goldberg, Persky<br>Motley, Rice |
| 8/2/05 | Pagano v. Anheuser-Bush, et al. | Motley, Rice |
| 7/21/05 | Picker & Hogan v. CSX | Gavin Law Firm |
| 5/19/05 | Various Mobil cases | Reaud, Morgan & Quinn |
| 5/10/05 | West Virginia asbestos cases | Goldberg, Persky<br>Motley, Rice |
| 4/28/05 | Various Delaware asbestos cases | Jacobs & Crumplar |
| 4/26/05 | Pagano | Motley, Rice |
| 4/22/05 | State of Indiana asbestos cases | Motley, Rice |
| 4/21/05 | Dummitt, Kibbey & Jenkins v. CSX | Sales, Tillman & Wallbaum |
| 3/11/05 | Guy v. CSX | Sales, Tillman & Wallbaum |
| 3/29/05 | Bramlett & King | Motley, Rice |
| 2/1/05 | Durham | Motley, Rice |
| 1/6/05 | West Virginia asbestos cases | Goldberg, Persky |
| 12/7/04 | Tanner v. Garlock, et al. | Motley, Rice |
| 10/26/04 | King v. BNSF | Richard Dinsmore |
| 9/23/04 | Potts v. AcandS, et al. | Motley, Rice |
| 8/26/04, 9/30/04 | Adams v. AW Chesterton, et al. | Motley, Rice |
| 6/17/04 | Lone v. CSX | C. Marshall Friedman |
| 5/18/04 | Brown v. AcandS, et al. | Motley, Rice |
| 4/29/04 | State of Indiana asbestos cases | Motley, Rice |
| 4/22/04 | Curta v. Mcdonald Supply, et al. | Motley, Rice |
| 4/15/04 | Burton v. CSX | Sales, Tillman & Wallbaum |
| 2/26/04 | West Virginia asbestos cases | Motley, Rice |
| 2/13/04 | O'Bannon v. CSX | Sales, Tillman & Wallbaum |
| 1/20/04 | Schiller v. AC & S | Motley, Rice |

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|---|---|---|
| 12/8/03 | Morrison v. CSX | Mark Coulter |
| 11/26/03 | Robinson v. NVF & Electric Hose & Rubber | Jacobs & Crumplar |
| 11/4/03 | West Virginia asbestos cases | Motley, Rice |
| 10/27/03 | West Virginia asbestos cases | Motley, Rice |
| 10/3/03 | Shutters et al. v. Brush Wellman | Andrew Lipton |
| 10/2/03 | Kennedy v. Norfolk & Western RR | John Roven |
| 9/12/03 | Yeager v. Marathon Oil, et al. | Motley, Rice |
| 10/2/03 | Kennedy v. Norfolk & Western RR | John Roven |
| 8/26/03 | High v. CSX | Mark Coulter |
| 7/19/03 | Weininger v. United Gilsonite Laboratories | Bernstein, Shur, Sawyer & Nelson |
| 5/9/03 | Bowers and Weiss | Motley, Rice |
| 2/28/03 | Andrews v. Burlington Norther Santa Fe RR | Schlichter, Bogard & Denton |
| 1/14/03 | Donzella v. New Jersey Transit | George Katchmar |
| 12/10/02 | Emmi | Jacobs & Crumplar |
| 10/2/02 | Seaford v. Norfolk Southern RR | Kevin McDermott |
| 9/19/02 | West Virginia asbestos cases | Ness, Motley |
| 5/8/02 | Ferrell, et al. V. CSX | Mark Coulter |
| 3/12/02 | Roberts & Denny v. AC&S | Ness Motley |
| 1/9/02 | Gregory v. Norfolk & Western RR | Mark Coulter |
| 1/02/02 | West Virginia asbestos cases | Ness, Motley |
| 12/28/01 | Tuck v. Maremont Corp. | Ness, Motley |
| 12/13/01 | Asbaucher v. AcandS, Inc., et al. | Ness, Motley |
| 8/9/01 | Shesler, et al., v. Conrail | Doran & Murphy |
| 8/7/01 | Ernest Thompson v. CSX Transportation | William Gavin |
| 8/3/01 | Glenn Abe v. CSX Transportation | Mark Coulter |
| 7/31/01 | Daniels, et al., v. CSX Transportation | Mark Coulter |
| 7/3/01 | Chapman v. CSX Transportation | Mark Coulter |
| 6/22/01 | David Bryant v. Armstron World, et al. | Ness, Motley |
| 6/7/01 | Byrd, et al., v. Illinois Central Gulf RR | Thomas Brock |

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| 5/3/01 | Ashworth, et al., v. CSX Transportation | The Sutter Law Firm |
| 5/1/01 & 7/16/01 | Edward Ayers v. Shipley Co. | Thornton & Naumes |
| 4/6/01 | Puckett, et al., v. N&W RR | James F. Humphries |
| 3/9/01 | Minnix v. N&W RR | James F. Humphries |
| 3/9/01 | Boxx, et al., v. Illinois Central Gulf RR | Thomas Brock |
| 1/10/01 | John Wilson, et al., v. Brush Wellman, Inc. | Andrew Lipton |
| 12/21/00 | Cobb v. CSX Transportation | Glasser & Glasser |
| 10/5/00 | York v. CSX Transportation | Sutter & Enslein |
| 9/28/00 | Thompson v. Anchor Packing, et al. | A. Russell Smith |
| 5/5/00 | Goff v. N&W RR | James F. Humphries |
| 7/10/00 | Earl Curry v. Union Pacific RR | Glasser & Glasser |
| 5/31/00 | Various v. Illinois Central RR | T. Brock |
| 2/18/00 | Washington v. BOC Group | W. Lewis |
| 2/4/00 | Amason v. Allied Signal | W. Lewis |
| 1/18/00 | Alverson v. Beasley, Callahan v, LAQ | W. Lewis |
| 12/8/99 | Underwood v. Norfolk Southern | W. Lewis |
| 12/6/99 | Boren v. B.N.S.F | C. Cortez |
| 11/19/99 | Wallace v. Burlington Southern | W. Lewis |
| 11/18/99 | Watson v. Exxon | M. Gertler |
| 11/17/99 | Smith v. General Electric & Boston Edison | Terry Dangel |
| 10/29/99 | Adams v. Conrail | Mark Coulter |
| 1/20/99 | Birtwell v. 28 State Street Limited Partnership | Terry Dangel |
| 11/9/98 | Rhodes et al. v. Allied Chemical et al. | Peyton, Parenti & Whittington |
| 10/22/98, 11/9/98, 4/9/99 | Catherine Breen et al. v. W. A Berry et al. | Albert Zabin |
| 9/17/98 | Hodges v. Norfolk & Western Railway Co. | James F. Humphries |
| 4/16/98, 6/2/98 | Magness v. KC Wall Products & US Gypsum | Mark Furney |

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|---|---|---|
| 2/19/98 | Carter v. Glidden | Kehoe, Doyle, Playter & Novick |
| 2/16/98 | Lacey v. Metro North | Collins, Collins & Kantor |
| 6/12/97 | Melvin v. Norfolk Southern | Miller & Bondurant |
| 7/10/97 | Barron, et al., v. CNA Insurance, et al., Jefferson County, AL | Ness, Motley |
| 9/4/97 | Abshire, et al. v. Anchor Packing, et al., Roanoke, VA | James F. Humphreys |
| 12/17/97 | Trujillo v. AT&SF, Albuquerque, NM | John Roven |
| 11/26/97 | Patricia Arnold v. Dow Chemical Co., New York | Baron & Budd |
| 11/25/97 | Wicker, et al., v. CONRAIL, Altoona, PA | Stevens & Johnson |
| 12/9/97& 12/30/97 | Harry Reynolds v. Ford Motor Co., Boston, MA | Allen Rodman |
| 7/16/97 | William Bailey v. Southern Pacific, Denver, CO | Yaeger, Jungbauer |
| 5/2/97 | Robert T. Ayers v. CSX Transportation Nashville, TN | Miller & Bondurant |
| 4/18/97 | Hallie Quick v. CSX Transportation | |
| 2/18/97 | Kabonic v. Kansas City Southern RR Co Kansas City, Kansas | Jones & Granger |
| 2/6/97 5/15/97 | Reed v. Union Pacific, etc. Little Rock, Arkansas | Kujawski & Faerber |
| 11/3/95 | Vernon Boyd v. Illinois Central RR Mississippi | Thomas W. Brock |
| 2/12/96 | John Marcisz v. Norfolk & Western Railway Belleville, Illinois | Brown & Gavin |
| 4/13/96 | Abernathy et al. v. AC&S, et al. Location unknown | Ness, Motley |
| 4/23/96 | Price v. N&W Railway Co., Gillespie v. N&W Railway Co. West Virginia | Ness, Motley |
| 5/14/96 | J. Bruggeling v. Conrail & New Jersey Transit, Lang v. Metro North Commuter RR Jersey City, New Jersey | Horn, Schechtman & Hirsch |

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| 2/7/95 | Michael Moran v. ConRail<br>Jersey City, New Jersey | Horn, Schechtman & Hirsch |
| 9/23/94, 10/11/94 | Cardoza v.Metro North<br>Jersey City, New Jersey | Horn, Schechtman & Hirsch |
| 10/7/94 | J. Nolan v. BP Chemicals, et al.<br>Baton Rouge, Louisiana | Chandler Loupe |
| 9/13/94 | Johnnie May Hamilton v. Illinois Central Gulf Railroad<br>Unknown | S. Mark Wann |
| 1/14/94, 2/2/94, 2/4/94 | Commonwealth of Massachusetts v. Owens Corning Fiberglas, et al.<br>Boston, Massachusetts | Dangel & Fine |
| 2/4/94 | Cottrell v. Alton & Southern Railway Co.<br>East St. Louis, Illinois | Kujawski & Faerber |

11/4/2020

# Trial Testimony - 1994-2020

## Michael J. Ellenbecker, Sc.D., CIH

| Date | Case | My Client |
|---|---|---|
| 8/18/20 & 8/20/20 | Wilgenbusch case | Maune, Raichle |
| 2/4/20 | Smith case | Bern Cappelli |
| 10/21/19 | Lewis case | Motley Rice |
| 3/27/19 | Davis case | Bern Cappelli |
| 10/30/18 | Grathen case | Bern Cappelli |
| 9/18/18 & 9/20/18 | Summerlin case | Shepard Law |
| 2/6/18 | Zalinski case | Bern Cappelli |
| 1/31/18 | Evans case | Bern Cappelli |
| 9/12/17 | Sylvestre case | Thornton Law Firm |
| 1/6/17 | Espinosa case | Kazan, McClain |
| 3/10/16 | Vega case | Maune, Raichle |
| 2/4/16 | White case | Satterley & Kelley |
| 9/17/15 | Trejo case | Kazan, McClain |
| 6/19/15 | Solarzano case | Kazan, McClain |
| 6/10/15 | Gilvin case | Levy, Konigsburg |
| 9/23/13 | Nelson case | Kazan, McClain |
| 4/23/13 | Grigg case | Kazan, McClain |
| 12/17/12 | CSX v. Peirce Associates | DeForest, Koselnik |
| 2/7/12 | Dye case | Porter & Malouf |
| 9/7/11 | Stillman case | Sales, Tillman, Wallbaum, Catlett & Satterley |
| 2/8/11 | Oakes case | Porter & Malouf |
| 11/8/10 | Bankhead v. Ford Motor Co. et al. | Sales, Tillman, Wallbaum, Catlett & Satterley |
| 2/19/10 | Montgomery v. CSX | Sales, Tillman, Walbaum, Catlett & Satterley |

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| 10/2/09 | Lone v. CSX | Sales, Tillman, Walbaum, Catlett & Satterley |
| 2/19/09 | White v. CSX | Sales, Tillman, Walbaum, Catlett & Satterley |
| 8/27/08 | Kennedy v. Illinois Central | Law Offices of William S. Guy |
| 7/17/08 | Hudson v. CSX | Sales, Tillman, Walbaum, Catlett & Satterley |
| 3/14/08 | Montgomery v. CSX | Sales, Tillman, Walbaum, Catlett & Satterley |
| 3/3/08 | Whisnant v. DuPont | Reaud, Morgan & Quinn |
| 1/28/08 | Lone v. CSX | Sales, Tillman, Walbaum, Catlett & Satterley |
| 5/30/07 | Vucelich v. Norfolk Southern | Motley Rice |
| 5/15/07 | Kibby & Dummitt v. CSX | Sales, Tillman, Walbaum, Catlett & Satterley |
| 5/8/07 | Claxon v. CSX | Motley, Rice |
| 4/18/07 | Lone v. CSX | Sales, Tillman, Walbaum, Catlett & Satterley |
| 11/1/06 | Hayes v. CSX | Sales, Tillman, Walbaum, Catlett & Satterley |
| 9/14/06 | Hensley v. CSX | Sales, Tillman, Walbaum, Catlett & Satterley |
| 8/31/06 | Williams v. CSX | Sales, Tillman, Walbaum, Catlett & Satterley |
| 5/18/06 | Hyatt et al. v. Illinois Central | Gavin Law Firm |
| 4/21/06 | Aquirre et al. v. LIRR | Horn Schechtman |
| 3/24/06 | Denk et al. vs. CSX | Gavin Law Firm |
| 11/8/05 | Black v. CSX | Mark Coulter |
| 7/19/05 | Various plaintiffs vs. Weil McClain | Jacobs & Crumplar |
| 6/14/05 | Kibby, Jenkins, & Dummitt v. CSX | Sales, Tillman & Walbaum |
| 2/4/05 | O'Bannon v. CSX | Sales, Tillman & Walbaum |
| 2/25/05 | Dahlheimer | Sieben, Polk |
| 1/5/05 | Tanner v. Garlock, et al. | Motley, Rice |

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| 11/18/04 | Adams v. AW Chesterton, et al. | Motley, Rice |
| 11/9/04 | Combs v. Norfolk Southern | Porter & Malouf |
| 9/13/04 | Yeager v. Marathon Oil, et al. | Motley, Rice |
| 6/14/04 | Zabilansky | McRoberts & Roberts |
| 6/29/04 | Burton v. CSX | Sales, Tillman & Wallbaum |
| 11/10/03 | Cuomo v. Long Island RR | Wilentz Goldman & Spitzer |
| 9/3/03 | Moody v. CSX | Sales, Tillman & Wallbaum |
| 6/26/03 | Satava et al. v. CSX | Doran & Murphy |
| 5/29/03 | Bowers | Motley, Rice |
| 3/7/03 | Wilson case (video testimony) | Peter Angelos |
| 3/6/03 | Nevith v. Conrail & New Jersey Transit (video testimony) | Wilentz Goldman & Spitzer |
| 12/11/02 | Emmi | Jacobs & Crumplar |
| 10/18/02 | Seaford v. Norfolk Southern RR | Kevin McDermott |
| 10/7/02 | Kilbane v. Conrail | Doran & Murphy |
| 4/9,10/02 | Indianapolis mass asbestos trial | Ness, Motley |
| 4/8/02 | Daniels, et al., v. CSX Transportation | Mark Coulter |
| 1/30/02 | Chapman v. CSX | Mark Coulter |
| 4/30/01 | Michael E. Warren v. Conrail | Gene Horn |
| 10/10/00 | Adams v. Conrail | Mark Coulter |
| 6/9/00 | Various v. Long Island RR | Gene Horn |
| 4/4/00 | Boren v. Burlington Northern RR | R. Dinsmore |
| 12/17/99 | Birtwell v. 28 State Street Associates | Terry Dangel |
| 12/14/99 | Underwood v. Norfolk Southern RR | William Lewis |
| 9/21/99 | Aguirre, et al. v. Long Island RR<br>Brooklyn, NY | Gene Horn |
| 8/13/99 | Carter v. Glidden<br>Montpelier, VT | Rob Doyle |
| 4/4/97 | Peterson v. Owens Corning Fiberglas<br>Wichita, KS | Ness, Motley |
| 1/24/97<br>1/28/97 | Crouch v. CSX<br>Portsmouth, VA | Miller & Bondurant |

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| 10/23/95 | Lipari v. Conrail (?)<br>Jersey City, New Jersey | Horn, Schechtman & Hirsch |
| 2/2/96 | Cross v. New Jersey Transit<br>Jersey City, New Jersey | Horn, Schechtman & Hirsch |
| 6/13/96 | Kapsis v. PATH<br>Jersey City, New Jersey | Horn, Schechtman & Hirsch |
| 6/6/96 | Price v. N&W Railway Co., Gillespie v. N&W Railway Co.<br>West Virginia | Ness, Motley |
| 6/5/96 | The Estate of Thomas Sullivan, et al., v. AC&S, Inc., et al.<br>Boston, Massachusetts | Ashcraft & Gerel |
| 2/8/95 | Michael Moran v. ConRail<br>Jersey City, New Jersey | Horn, Schechtman & Hirsch |
| 10/13/94 | Cottrell v. Alton & Southern Railway Co.<br>Belleville, Illinois | Kujawski & Faerber |
| 10/11/94 | Murphy v. PATH<br>Jersey City, New Jersey | Horn, Schechtman & Hirsch |
| 4/22/94 | Commonwealth of Massachusetts v. Owens Corning Fiberglas, et al.<br>Boston, Massachusetts | Dangel & Fine |
| 2/25/94 | Modesto Webb, et al., v. Sohio Chemical Co., et al.<br>Baton Rouge, Louisiana | Chandler Loupe |
| 2/15/94 | Broadhacker v. Southwestern Railway<br>Belleville, Illinois | Brown & Gavin |

# EXHIBIT B

**Materials Reviewed and Relied Upon:**

For purposes of this report, I have relied upon my education, training, clinical experience, my own research, knowledge of the pertinent medical and scientific literature, and review of the following material:

**Deposition Transcripts:**
September 29, 2020 Deposition of Kirk Morris
October 29, 2020 Deposition of John Price
August 12, 2016 Deposition of Tom Bock
August 4, 2016 Deposition of Steven Cherry
July 27, 2017 Deposition of Christopher Eich
July 25, 2017 Deposition of Sean Healey
August 24, 2017 Deposition of Stephen McCracken

**Phase I Trial Transcripts:**
2018-10-16 Adkisson v. Jacobs - Trial Transcript (Vol. I)
2018-10-17 Adkisson v. Jacobs - Trial Transcript (Vol. II)
2018-10-18 Adkisson v. Jacobs - Trial Transcript (Vol. III)
2018-10-19 Adkisson v. Jacobs - Trial Transcript (Vol. IV)
2018-10-22 Adkisson v. Jacobs - Trial Transcript (Vol. V)
2018-10-23 Adkisson v. Jacobs - Trial Transcript (Vol. VI)
2018-10-24 Adkisson v. Jacobs - Trial Transcript (Vol. VII)
2018-10-25 Adkisson v. Jacobs - Trial Transcript (Vol. VIII)
2018-10-29 Adkisson v. Jacobs - Trial Transcript (Vol. IX)
2018-10-30 Adkisson v. Jacobs - Trial Transcript (Vol. X)
2018-10-31 Adkisson v. Jacobs - Trial Transcript (Vol. XI)
2018-11-01 Adkisson v. Jacobs - Trial Transcript (Vol. XII)
2018-11-02 Adkisson v. Jacobs - Trial Transcript (Vol. XIII)
2018-11-06 Adkisson v. Jacobs - Trial Transcript (Vol. XIV)
2018-11-07 Adkisson v. Jacobs - Trial Transcript (Vol. XV)

**Phase I Trial Exhibits, including but not limited to:**
Exhibit 1 – Site Wide Safety and Health Plan (Revision 1)
Exhibit 2 – Site Wide Safety and Health Plan (Revision 2)
Exhibit 3 – Site Wide Safety and Health Plan (Revision 3)
Exhibit 4 – Site Wide Safety and Health Plan (Revision 4)
Exhibit 5 – Site Wide Safety and Health Plan (Revision 5)
Including but not limited to Appendix K, Industrial Hygiene Monitoring Plan
Exhibit 6 – Site Wide Safety and Health Plan (Revision 6)
Including but not limited to HSE-07 Industrial Hygiene Personal Air Monitoring Procedure and Appendix K, Industrial Hygiene Monitoring Plan
Exhibit 7 – Site Wide Safety and Health Plan (Revision 7)
Including but not limited to Appendix I, Industrial Hygiene Monitoring Plan
Exhibit 61 – 2014-12-05 Industrial Hygiene Monitoring Plan Final Report

Exhibit 66 – 2013-02-20 KRP HSE-07 Industrial Hygiene Personal Air Monitoring Procedure (Rev 0)
Exhibit 67 – 2013-12-11 KRP HSE-07 Industrial Hygiene Personal Air Monitoring Procedure (Revision 1)
Exhibit 71 – April 3, 2009, Shaw Group Letter to Tommy Lucas re. radium sampling
Exhibit 79 – 2009-09-17 Eberline Analytical Report of Analysis
Exhibit 80 – 2009-10-0 Eberline Analytical Report of Analysis
Exhibit 85 – 2009 Calendar of sample events rain
Exhibit 86 – 2009 Calendar of sample events
Exhibit 87 – 2010 Calendar of sample events rain
Exhibit 89 – 2011 Calendar of sample events rain
Exhibit 90 – 2011 Calendar of sample events
Exhibit 91 – 2012 Calendar of sample events rain
Exhibit 94 – 2013 Calendar of sample events
Exhibit 96 – 2010_07 Monthly Industrial Hygiene Monitory Summary
Exhibit 99 – 2010 to 2012 Monthly IH Summary Reports to TVA
Exhibit 100 – 2009-08-04 TVA Site Dust Control and Air Monitoring Plan
Exhibit 101 – 2009-08-14 TVA Site Dust Control and Air Monitoring Plan
Exhibit 103 – 2011-09-26 TVA Site Dust Control and Air Monitoring Plan
Exhibit 104 – 2012-10-31 TVA Site Dust Control and Air Monitoring Plan
Exhibit 167 – 2013-06-13 Emails re. IH Sample Results Labs
Exhibit 175 – 2013-06-21 Bock Summary of IH Monitoring re lawsuits
Exhibit 309 – Knoxville Sentinel Photo Cloud of Coal Ash Above Cleanup Site
Exhibit 328_2009-08-26 Photo of Dust Cloud
Exhibit 329_2009-08-26 Photo of Dust in Air
Exhibit 330_2009-08-26 Photo of Dust in Dusk
Exhibit 332_2009-08-26 Photo of Dust in Sky
Exhibit 333_2009-08-26 Photo of Dust on Site
Exhibit 334_2009-08-26 Photo of Dust Over Site
Exhibit 341_2009-10-01 Photo of Dust Covering Smokestack
Exhibit 342_Photo of ash movement
Exhibit 343_2009-11-14 Photo of Dust on Truck
Exhibit 352_Photo of worker break area (2)
Exhibit 358_2010-02-12 Photo of Dust Cloud Above Excavator
Exhibit 359_2010-03-13 Photo of Dust Around Working Trucks
Exhibit 360_Photo of ash excavation and loading with dust
Exhibit 361_Photo of ash excavation and loading with dust (2)
Exhibit 362_Photo of ash excavation and loading with dust (3)
Exhibit 363_Photo of dust on filter in HVAC for trailer
Exhibit 365_2010-03-19 Photo of Inside Office
Exhibit 369_2011-10-12 Photo of Dust in Port-a-potty
Exhibit 371_Photo of Outdoor Break Area
Exhibit 372_2009-12-12 Photo of Coal Ash on Worker Face
Exhibit 373_2009-12-12 Photo of Workers in Coal Ash
Exhibit 399 – Gibson – Dust Collection Video

**Photographs:**
Various photos of the site that can be produced upon request, including but not limited to: GCPLA000001-GCPLA000023.

**Air Monitoring Documents Produced by EnSafe and Jacobs, including:**
2009, 2010 - 1578 separate documents produced by EnSafe
2010 – JEGS 0071481 – IH 2010
2011 – JEGS 0072096 – IH 2011 Part 1
2011 – JEGS 0073043 – IH 2011 Part 2
2012 – JEGS 0074196 – IH 2012
2013 – JEGS 0075523 – IH 2013
2014 – JEGS 0076423 – IH 2014

**Expert Reports:**
Elizabeth Ward, PhD
Joseph Graziano, PhD
Michael Ellenbecker, PhD
Norman Kleiman, PhD

**Addenda:**
In addition to the materials listed above, I have also reviewed all of the materials listed in the individualized exposure assessments, which are attached as Addenda to this report.

# EXHIBIT C

# SITE WIDE SAFETY AND HEALTH PLAN

# FOR THE

# TVA KINGSTON FOSSIL PLANT

# ASH RELEASE RESPONSE

*Prepared for:*

Tennessee Valley Authority

*Prepared by:*

*Jacobs*
*125 Broadway Ave*
*Oak Ridge, TN 37830*

**January 2013**

EXHIBIT
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# APPENDIX K
# INDUSTRIAL HYGIENE MONITORING PLAN

# APPENDIX K

# INDUSTRIAL HYGIENE MONITORING PLAN
# R1 April, 2012

## SITE WIDE SAFETY AND HEALTH PLAN

**For the**

## TVA KINGSTON FOSSIL PLANT

## ASH RELEASE RESPONSE

## TABLE OF CONTENTS

## LIST OF TABLES



## ATTACHMENTS

# 1.0 INTRODUCTION

## 1.1 BACKGROUND

This Industrial Hygiene Monitoring Plan (IHMP) has been developed as Appendix K to the TVA Kingston Fossil Plant (KIF) Site Wide Safety and Health Plan (SWSHP). The intent of this IHMP is to fully develop, discuss, and apply the monitoring strategy associated with relevant sections of the SWSHP. In the event the SWSHP is updated, this IHMP will be reviewed and updated as necessary.

The preliminary IHMP entitled "Kingston Fossil Plant Coal Ash Recovery Site Industrial Hygiene Monitoring Plan" was prepared by EnSafe Inc. and was submitted on January 21, 2009 as an amendment to the Ash Recovery Site Safety Plan. The purpose of the preliminary IHMP was to outline the EnSafe air monitoring activities during the project. This plan revises and updates the preliminary IHMP and any subsequent plans submitted in draft or final form by EnSafe. Portions of the EnSafe IHMP have been referenced and utilized within this document.

Industrial hygiene (IH) activities began on December 30, 2008 with air monitoring being performed for fly ash and its constituents. Standard methods commonly employed by TVA and EnSafe for evaluating exposures to fly ash constituents during fossil boiler outages or day-to-day production or maintenance activities were implemented during the early phase of the project.

## 1.2 GENERAL INDUSTRIAL HYGIENE OBJECTIVES

Evaluation and control of health related exposures on the Kingston Ash Recovery Project site are key to ensuring and maintaining the health of the site work force, particularly as the project duration creates the potential for chronic exposures to become relevant.

In addition to worker protection, a properly developed and executed Industrial Hygiene Program will provide a repository of historical information for future use.

The principal objectives of the plan are as follows:

- Identify specific responsibilities for site Health, Safety, and Environment (HSE) staff and operations management with regard to Industrial Hygiene Program support.
- Identify the various Similar Exposure Groups (SEG) to be monitored onsite with the intent of drawing group level conclusions with regard to health exposures and controls.
- Specify the target stressors (chemical, physical, biological) that will require routine monitoring for each SEG.
- Identify specific action levels to trigger mitigation or programmatic development activities. These may include field controls, work techniques, training, medical monitoring, or utilization of personal protective equipment.
- Document the monitoring protocols for the site including frequency, specific analytes to be monitored for, and the sample methods to be employed.
- Establish a means to create and distribute proper IH documentation to TVA management, operational management, TVA contractors, and individual workers.

## 1.3 KEY INDUSTRIAL HYGIENE PERSONNEL AND RESPONSIBILITIES

General site safety and health responsibilities are established under Job Descriptions of the Kingston Ash Recovery Project Management Plan. This section is included as it specifically relates to executing the onsite IH Program.

### 1.3.1 Jacobs Site HSE Manager

The HSE Manager will be the key liaison between TVA / Jacobs Engineering Group Inc., (Jacobs) management and those technical specialists performing IH activities onsite. The HSE Manager's responsibilities include: providing summary and transmittal reports as necessary, provides recommendations for control strategies as related to occupational health exposures, development of site-wide guidance, issuance of sample notification letters, ensuring proper training and skill sets are present in site IH personnel, and reporting in relation to IH findings.

### 1.3.2 Jacobs Site Industrial Hygiene Lead Technologist

The IH Lead Technologist will be responsible for:

- Executing the general monitoring strategy outlined in this plan with guidance from the HSE Manager.
- Keep the Jacobs Site HSE Manager apprised of findings on a daily basis.
- Consulting with Jacobs' Certified Industrial Hygienist (CIH) staff when difficulties or anomalous findings are identified.
- Maintaining and calibrating IH equipment per manufacturer's requirements.
- Proper handling of samples including chain-of-custody (CoC).
- Completing exposure monitoring paperwork on a daily basis.
- Observing workers being monitored and documenting relevant information.

### 1.3.3 Jacobs Industrial Hygiene Manager

The IH Manager is responsible for assisting in the development of this IHMP general IH monitoring strategies, evaluation of exposures, and providing recommendations for control strategies when necessary.

### 1.3.4 Data Management and Quality Assurance Team

The onsite Data Management Team and Quality Assurance (QA) Team assist the IH Program with respect to laboratory coordination, laboratory data management, data validation, QA, and data storage in EQuIS® in accordance with Section 6.3 of this plan.

# 2.0 INDUSTRIAL HYGIENE PROCESS OVERVIEW

## 2.1 IDENTIFY SIMILAR EXPOSURE GROUPS

The collaboration of TVA Safety and IH staff, EnSafe, and Jacobs have established SEGs for differing categories of employees with potentially or expected similar exposures from work conducted at the Kingston Ash Recovery Project site. Segregation into SEGs is a function primarily of equipment-specific positional assignments or site responsibilities. As sampling is performed, task assignments will be noted on sample notes and recorded in the sample records/database used, but may also be dependent on activities. In the event results are elevated, task level controls will be implemented for that task.

Table 2-1 contains a listing of SEGs presently identified for the Kingston Ash Recovery Project operations. As activities change or are added to the site, additional exposure groups may be added as necessary.

**Table 2-1**
**Similar Exposure Groups Identified at Kingston Ash Recovery Project Site**
**(with activity/task subsets)**

| **Site-Wide Staff Support** | **On-Water Operator** | **Teamster** |
|---|---|---|
| Field Staff | Boat Operator | Artic Dump Truck Operator |
| Mgmt / Admin (Office Staff) | Dredge Boat Operator | Dump Truck Operator |
| Misc. | Dredge Shore Operator | Fuel Truck Driver |
| Sample Technician | Tugboat Operator | Vacuum Truck Operator |
| Security | Vacuum Barge Operator | Water Truck Operator |
| | | |
| **On-Land Operator** | **On-Water Laborer** | **Railcar Loadout Laborer** |
| Amphib Excavator Operator | Boat Laborer | Loadout Laborer (Railcar) |
| Booster Pump Operator | Deck Hand | Polymer |
| Buggy Operator | Dredge Laborer | Railcar Loading - Closer |
| Clam Bucket Operator | Fuel Boat Crew | Railcar Loading - Liner |
| Crane Operator | | |
| Dozer Operator | **Mechanic** | **Railcar Loadout Operator** |
| Excavator Operator | Heavy Equipment Mechanic | Railcar Loading - Dozer |
| Forklift Operator | Equipment Mechnanic, Heavy | Railcar Loading - Excavator |
| Fuel Truck Operator | Equipment Mechanic | |
| Grader Operator | | **On-Land Laborer** |
| Lime Application/Mixing | **Filter Press Operations** | Decon Laborer |
| Pump Operator | Filter Press | Decon Laborer (vacuum) |
| Scraper Pan Operator | Filter Press Foreman | Equipment Decon Detail |
| Shoreline Operator (river ops) | Filter Press Operator | Flagger |
| Track Dump Operator | | General Laborers |
| | **Perimeter Wall Crew** | Rail Maintenance Laborer |
| **Drill Crew** | BP_Forklift Operator | River Ops - Shore Laborer |
| | BP_Gen Laborer | Water Truck Laborer |
| **Hydroseed Crew** | BP_Mixing Operator | |
| | SW_Dozer Ops | |
| **Southern Shores** | SW_Excavator | |
| | SW_Gen Laborer | |

## 2.2 EVALUATE

Periodic monitoring and sampling schedules will be based on the severity of potential exposures to recognized health hazards and possibly other factors such as number of personnel exposed and frequency of task performances, etc. This will be periodically reviewed and sample priorities updated as warranted.

The Site IH Lead Technologist, in collaboration with TVA and Jacobs CIH staff, will conduct a Health Hazard Analysis of existing and new SEGs identified on the site using Form 124 (Attachment 1), Sample Health Hazard Evaluation by Exposure Group. Table 2-2 will be used to initially evaluate the potential for exposures to exist. Existing data will be used to evaluate exposures based on SEGs. Where existing data is not available, an objective exposure determination will be made which may include the use of calculations, direct read monitoring and integrated monitoring. This process will continue for each SEG and each recognized health hazard until adequate exposure characterization has been completed.

The qualitative exposure assessment captured by Table 2-2 includes an evaluation of potential chemical exposures via inhalation, ingestion, and dermal contact and/or absorption. The assessments also include the potential exposures to noise and radiation and other potential physical hazards. The predominant exposure determinants and events such as frequency, magnitude, and variability of exposure and tasks, route of exposure, potentials for acute or chronic exposures or frequently repeated tasks and exposures along with the adequacy and potential for failure of engineering and work practice controls are considered as a part of the qualitative exposure assessment.

As new processes and tasks are identified on the Kingston site, the potential hazards will be included in the associated work package and job safety analysis. The new processes will either be captured within the monitoring plan for existing SEGs or new SEGs will be created. The Jacobs IH staff will determine new strategies, as appropriate, to evaluate new potential exposures. If the qualitative exposure assessment indicates a minor, or no risk of exposure, no further action is required.

## 2.3 DOCUMENT CONTROL, REPORTING, AND NOTIFICATION

Independent of routine reporting, electronic and paper files will be kept for project documentation purposes. This information will be properly controlled and handled via the project Document Control process and includes CoCs, raw and interpreted lab data, exposure calculations, copies of distributed reports, copy of field notes, copies of calibration records, and other information relevant to the onsite IIH Program. All records must be maintained by TVA and associated employers for a minimum of 30 years.

Various reports and notification activities will occur as a result of IH activities at the site. The following is a summary of the reports and their frequency.

### 2.3.1 Worker Notification

Employees will be notified of the results of all sampling regardless of levels recorded. For personal exposure monitoring, this will generally consist of specific notification letters. Employee notification letters for TVA staff will be provided by Jacobs for distribution by TVA Safety staff. Jacobs will distribute letters to the employer of subcontracted personnel. The

employer will distribute to the subcontracted personnel. A signed copy of the notification letter will be returned to document control by the employer.

### 2.3.2 Site-Wide Notification

In the event results dictate the need to notify SEGs or the entire site, Jacobs will develop the notification announcement and distribute via email, postings, and other announcements as necessary.

### 2.3.3 Daily Reporting

Relevant IH information will be verbally shared during the Health and Safety daily meeting. Included will be general discussion of IH activities and any notable observations.

### 2.3.4 Monthly Reports

Formal monthly reports of IH activities performed onsite include interpreted results summary, general conclusions about exposure levels (ELs), any identified areas of concern, and actions required or taken to resolve these concerns.

This report will be generated by the Jacobs Site HSE Manager, or their designee, and will be reviewed by the Jacobs IH Manager prior to distribution. Due to the lag time in receiving lab results, the report will be issued no later than the end of the following month for the previous month barring any unexpected delays such as data validation (e.g., end of July for June results).

## 2.4 VERIFY UPPER CONFIDENCE LIMITS AND MANAGE FURTHER MONITORING

When integrated monitoring is performed, a statistically significant sample of workers will be selected for exposure monitoring per the direction of the Site IH Manager, recommended National Institute of Occupational Safety and Health (NIOSH) sample methods, and other recognized industry standards. Nearby areas or employees may be monitored if it is suspected there is a dispersed impact of the contaminants of concern, however, these personnel will not count toward the statistical significance of the task workers monitored.

An evaluation of all exposure groups will be performed to determine exposure potential for recognized stressors. If data gaps exist, additional monitoring will be performed until all SEGs have been adequately characterized. Once an exposure group is adequately characterized, ELs will be statistically evaluated. If data sets are large enough, parametric statistics will be utilized using the 95$^{th}$ percentile Upper Confidence Limit (UCL). For small data sets, Bayesian statistics will be utilized to determine with 95% confidence which exposure bands (per Table 2-2) the associated levels fall into. Applicable ELs will be those listed in Section 4 and Table 4-2 of the SWSHP or the most recent version of applicable Federal, State, or Occupational Safety and Health Administration (OSHA) regulations or the most recent edition of the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values booklet.

**Table 2-2**
**Summary of Exposure Monitoring Actions**

| If the UCL is | The Exposure is Deemed | Further Monitoring consists of |
|---|---|---|
| <10% of the EL | Insignificant | Verifying the process and exposure potential remain unchanged |
| >10% and <50% of the EL | Marginal | Quarterly integrated |
| >50% and <100% of the EL | Significant | Monthly integrated |
| >100% | Unacceptable | Routinely until controls have adequately lowered exposures |

If an Action Level in Section 4 of the SWSHP is exceeded, notification will be made verbally in the daily Health and Safety meeting. A preliminary review and validation will be conducted by the Site HSE Manager or the Jacobs CIH. The activities, equipment, and conditions of the day of sampling are evaluated to determine potential contributing factor(s) to the exposure, with the goal of preventing similar situations or identifying controls to reduce exposures to below criterion levels.

Depending on the results of the preliminary review and validation, additional sampling or review may be necessary, or action items recommended for review. Exceedances indicating the need for upgrading respiratory protection will be immediately brought to the attention of the TVA and Jacobs Program Managers.

# 3.0 IDENTIFICATION OF MONITORING NEEDS

The need to include personnel or areas in IH monitoring programs will be based on a number of factors; however, they will be primarily based on assessing the potential exposures of routine field activities.

## 3.1 EXISTING PROCESS

Currently the recognized processes onsite include; ash removal from land-based release areas, ash removal from existing storage areas, ash stacking, site maintenance, equipment maintenance, drilling, field supervision, perimeter wall construction, and office activities. These processes may occur within a number of different scenarios or with different contractors; however, the relative occupational exposures and stressors are expected to be relatively consistent.

## 3.2 NEW PROCESS

In the event new activities are added, an evaluation will be conducted to determine if new SEGs are created from those activities. If new SEGs are added, they will be included for routine monitoring along with other SEGs. Monitoring priority will be based on potential for exposure.

## 3.3 WORKER COMPLAINTS

Worker complaints are to be taken seriously and will be given immediate attention for initial evaluation. Initial evaluation includes direct observation of the related tasks, reviews of existing data for similar sampling, utilization of direct read instruments, and, when appropriate, discussion with the individuals involved.

If it appears that worker complaints present valid or real potential exposures, those complaints will be addressed by conducting integrated monitoring as soon as practical.

## 3.4 MANAGEMENT REQUEST

Management requests will also be given priority for initial evaluation which will include direct observation of the related tasks, reviews of existing data for similar sampling, and when possible, utilization of direct read instruments.

If after initial evaluation no conclusions can be drawn about actual ELs, integrated monitoring will be conducted as soon as practical.

# 4.0 CHEMICAL HAZARD MONITORING METHODS

## 4.1 STRESSORS OF POTENTIAL CONCERN

Table 4-1 lists the potential chemical hazards currently identified for the site and the applicable NIOSH methods associated with the particular contaminate sampling and analytical methods. The NIOSH methods will be applied in conjunction with best management IH practices acknowledged by: the American Board of Industrial Hygiene (ABIH), American Industrial Hygiene Association (AIHA), ACGIH, and recommendations by AIHA certified laboratories.

**Table 4-1**
**Recognized Sample Methods to be Utilized**

| Method Number | Stressors of Potential Concern | Sampling Media |
|---|---|---|
| NIOSH 0500 | Particulates, Total | 37mm MWMCE[2] |
| NIOSH 0600 | Particulates, Respirable | 37mm PVC[3] |
| NIOSH 7300 | Aluminum, Antimony, Arsenic, Barium, Beryllium, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron Oxide, Lead, Magnesium, Manganese, Molybdenum, Nickel, Potassium, Selenium, Sodium, Thallium, Vanadium, Zinc Oxide | 37mm MWMCE |
| NIOSH 7500 | Silica, Amorphous; Silica, Quartz; Silica, Cristobalite; Silica, Tridymite | 37mm PVC |
| Per CHP[1] | Radium-226, Radium-228, Thorium-228, Thorium-230, Thorium-232, Thorium-234, Uranium-234, Uranium-235, Uranium-238 | 37mm MWMCE |
| NA | Misc. indoor air quality concerns (Office Trailers) | Varies |

**Notes:**
[1] Per CHP – as coordinated by TVA Certified Health Physicist
[2] MWMCE – matched weight mixed cellulose ester
[3] PVC – polyvinyl chloride

## 4.2 EVALUATION METHODS TO BE USED

Potential inhalation hazards to those Stressors of Potential Concern (SOPC) listed in Table 4-1 will be evaluated through proper sampling techniques and review.

To initially determine potential exposures, the Site Industrial Hygienist will first review prior documented data collected by TVA and EnSafe. An evaluation will be performed to determine if adequate characterization has been achieved for each SEG or if data gaps exist.

If data gaps appear to exist, an objective evaluation will be done utilizing when possible the following sequence:

1. Calculations or exposure modeling
2. Direct reading evaluations
3. Integrated monitoring techniques

If methods 1 or 2 provide information that, with conservative assumptions, can verify or "prove" no exposures, the evaluation will be properly documented and will stop at that point. If this

cannot be achieved, integrated monitoring will be performed and data collected until adequate conclusions can be drawn.

All integrated monitoring will be performed using recognized industry methods, primarily NIOSH Sample and Analytical Methods as guidelines. As a general rule, area or environmental samples will not be used to evaluate worker exposures as significant variability may exist between the stationary monitor and the mobile worker and their breathing zone. Area monitoring may be used to evaluate the general effectiveness of controls samples and the potential impact of downwind / offsite receptors.

Field quality control (QC) will require a minimum of one field blank for every 10 primary personal or area samples submitted for laboratory analysis. Field blank media will be selected randomly from the same lot as primary sample media. Field blanks will accompany primary samples onsite and during shipment to and from the laboratory.

## 4.3 FREQUENCY OF EXPOSURE MONITORING

Personnel identified by SEGs will be repeatedly monitored as needed to ensure potential inhalation hazards are controlled below Action Levels. Not all SEGs will be sampled with the same frequency, dependant on determining site factors, but all SEGs should be periodically re-evaluated to verify work activities have remained unchanged and data previously collected is still representative of current exposures. This should be done semi-annually for all active SEGs and documented in the monthly IH report. The actual sampling strategy for a specific day is determined or approved by the Site HSE Manager, project CIH, or designee.

Initially, frequency of exposure monitoring will be based upon the exposure risk rating identified for a given SEG. Once an SEG has been adequately characterized, additional verification monitoring will be based on Table 2-2.

## 4.4 EXPOSURE LIMITS

### 4.4.1 Sequential Analysis

A sequential analysis approach may be utilized for sample analysis strategy with the primary goals being optimizing data collection and increasing efficiency. The following option is provided as an example only; if other analytes or chemicals of concern are identified, other sequences may be employed for sample strategy.

Total particulate and metals samples: Samples are collected and initially analyzed for total particulate. If total particulate concentrations are at or above 0.5 milligrams per cubic meter, additional analysis is conducted for arsenic and cadmium provided they have adequate sample volume to record concentrations low enough to be meaningful.

If a lag in results is unacceptable due to project needs, the sequential analysis can be bypassed to allow analysis of all chemicals of concern simultaneously.

### 4.4.2 Action Levels

Action Levels for the site are typically not regulatory levels; however, several SOPCs have specific OSHA-defined Action Levels. If an OSHA Action Level does not exist, TVA generally

uses one-half of the time-adjusted Permissible Exposure Level (PEL) (Brief and Scala Method). Applicable action levels will be those listed in Section 4 and Table 4.2 of the SWSHP.

TVA is a Federal entity and is therefore governed by Federal OSHA PEL's. In addition, there are several contracting partners onsite that are required to follow the Tennessee (TN)-OSHA PEL's. The PEL's that will be mandated for compliance will be most conservative of either TN or Federal OSHA.

The Threshold Limit Valuesfound in ACGIH and/or the Recommended Exposure Limits found in NIOSH will be typically used as a lower level indicator to provide an early warning of potential exposure risks. These indications will provide an opportunity for initiating further reviews, performing an evaluation and implementing subsequent controls that will aid in maintaining exposures as low as reasonably achievable and maintain them to less than the established Action Levels required by law under both TN and Federal OSHA.

### 4.4.3 Exceedances

If an Action Level is exceeded, a preliminary review will be conducted by the Site HSE Manager; if this individual is not available, it will be conducted by the project CIH, TVA, or Site Safety staff. The activities, equipment, and conditions of the day of sampling are evaluated to determine potential contributing factors to the exposure with the goal of preventing similar situations or identifying controls to reduce exposures to below criterion levels.

Depending on the results of the preliminary review, additional sampling or review may be necessary, or action items recommended for review. Exceedances indicating the need for upgrading respiratory protection will be brought to the attention of the TVA Site Manager.

# 5.0 PHYSICAL HAZARD MONITORING

## 5.1 NOISE

There is a potential for personnel to be exposed to noise levels above the OSHA allowable maximum 8-hour Time Weighted Average during normal field operations. The Site Industrial Hygienist will first review TVA and EnSafe documentation to determine the severity of each existing noise exposure data prior to conducting sound level measurements and personal noise dosimetry on individuals in each SEG. Based upon this review and assessment, priority measuring will be conducted for those SEGs having the greatest need. Not all SEGs will require the same level of support or measurement; however, all SEGs should have or will be evaluated.

All noise sampling instruments and field calibrators will be maintained within the most current calibration cycles.

## 5.2 THERMAL STRESS

Heat stress monitoring equipment will typically consist of area sampling devices capable of Wet Bulb Globe Temperature measurements. Environmental heat measurements should be made as close as possible to the specific work area where the worker is exposed. Please note that for some operations (e.g., heavy equipment operations), this may require sampling inside the cab of applicable equipment. Equipment with air-conditioned cabs will generally not be sampled. Heat stress measurement equipment must have been serviced per manufacturer's specifications.

## 5.3 INDUSTRIAL ERGONOMICS

Numerous activities onsite present ergonomic stress and strain and the potential for personnel to suffer acute and chronic soft tissue injuries. An initial evaluation will be done of the various SEGs to determine if they fall within low, medium, or high potential for ergonomic injury.

Formal industrial ergonomic evaluations will be done for all those SEGs deemed to be at high risk for ergonomic problems. Controls will be implemented as necessary to minimize the related stressors. Once controls are implemented, a follow-up evaluation will be performed to verify they adequately address the issues identified.

Those SEGs falling into medium or low-risk categories will be evaluated on an as needed basis, primarily based on worker complaints or management request.

## 5.4 OFFICE ERGONOMICS

Those personnel who predominantly work in an office environment (project controls, administrative personnel, IT support, communications personnel, data management, etc.) should perform an initial self assessment of their work station to verify proper ergonomic configuration. If issues are identified or require input of an industrial hygienist, work station evaluations will be performed. In either case, all self evaluations and ergonomic consultations will be recorded and maintained within the IH project files.

## 5.5 FREQUENCY OF EXPOSURE MONITORING

Noise and ergonomic stressors will be evaluated until proper exposure characterization for each SEG can be established. Additional monitoring will be performed if the process is known to have changed in a manner that would increase the potential for exposure.

Thermal stress will be evaluated daily during periods of time where it is likely to create heat related conditions onsite and will remain consistent with the process outlined in Sections 5.3 and 5.4 of the SWSHP.

## 5.6 EXPOSURE LIMITS RECOGNIZED

Exposure limits and sources of limits vary significantly for associated physical hazards. The following breaks out recognized limits for likely physical hazards to be encountered onsite.

### 5.6.1 Noise

All exposure limits for noise will be based on 29 CFR 1910.95 – Occupational Noise Exposure. These limits are currently 90 dBA for an 8-hour exposure with an Action Level of 85 dBA for an 8 hour exposure. With extended work shifts frequently encountered onsite, PELs for noise will be adjusted using a 5 dB doubling rate and Table G-16 of 29 CFR 1910.95.

### 5.6.2 Heat Stress

Limits for heat stress are established in the SWSHP, Section 5.3, and follow TVA Safety Procedure 806 for heat stress control. It is generally recognized that the ACGIH limits established for heat stress are too conservative for acclimatized workers and on which will not be used to base work / rest cycles.

### 5.6.3 Ergonomics

Numerous standards exist for ergonomic control; however, none are considered regulatory. When ergonomic evaluations are conducted, results will be compared to recognized industry standards including NIOSH and the ACGIH.

# 6.0 QUALITY CONTROL / QUALITY ASSURANCE

## 6.1 EQUIPMENT CALIBRATION

Sampling and calibration of pumps and dosimeters will be conducted in accordance with equipment manufacturer recommendations, or as stipulated in the applicable OSHA or NIOSH Method. Personal sampling pumps will be flow rate calibration checked before and after each day's sampling per Site Guidance Document HSE-07 Industrial Hygiene Personal Air Monitoring Procedure (Appendix A to the SWSHP).

## 6.2 LABORATORY QUALITY CONTROL

All samples submitted for laboratory analysis will be analyzed by a lab accredited by the AIHA or participate in the National Voluntary Lab Accreditation Program. The use of non-accredited labs may be necessary for unusual analytes (e.g., NORM); in this case, approval of a CIH is required prior to submittal. Laboratories will be required to adhere to the contractual QC requirements and will be subjected to audits by the QA Team.

## 6.3 DATA VALIDATION

Data validation will be performed on data from personal integrated monitoring samples. The laboratory QC samples to be reviewed will include blanks, duplicates, lab control standards, and calibration verification standards. Sample completeness and field blank/field duplicate results will also be evaluated if available.

The purpose of the validation is to ensure that the reported data is usable for its intended purposes. Samples that are not within the acceptable criteria for parameters representing sample collection, handling and analysis criteria will be identified, from which assessments can be made of data usefulness. These criteria will be developed in conjunction with the selected laboratory using guidance from the laboratory accreditation body.

The laboratory will deliver sample data packages in parallel to both the project IH Program and the project Data Management Team/QA Team. For the IH Program, the following information is required:

- Summary data package in PDF form
- An Electronic Data Deliverable (EDD).

Upon receipt of the analytical laboratory data, the Site HSE Manager or designee compiles individual reports and assesses measured values against OSHA and other applicable exposure limits. Calculations of the dataset may be performed through an IH database, spreadsheet, or other methods to facilitate documentation of the review. The Site HSE Manager or designee also reviews measured values for reasonability against known field conditions associated with the sample, measurements taken elsewhere the same day, or historical measurements for a particular work activity.

The QA Team and TVA will receive an EDD and a Level IV data package. Upon receipt of the analytical laboratory data, the QA Team validates the data and the Data Management Team stores the data in EQuIS® in accordance with the Quality Assurance Project Plan for the Tennessee Valley Authority Kingston Ash Recovery Project (TVA-KIF-QAPP) and the Data

Management Plan for the Tennessee Valley Authority Kingston Ash Recovery Project (TVA-KIF-DMP-001, 2009)

If questions arise during data validation by either party, immediate communication must be made via email between the IH Team and the QA and Data Management Teams in order to ensure appropriate and parallel re-assessment of data is performed from a QA perspective. If data are required to be resubmitted by the laboratory, revised data will be sent in parallel to both the IH Program and the project Data Management Team/QA Team. All discrepancies will be reconciled prior to either dataset being considered final. Once both datasets are consistent, the data are considered final.

## 6.4 DATA QUALITY OBJECTIVES

The Data Quality Objective (DQO) process is a logical series of seven steps that guides investigators to a plan for IH data. The process is both flexible and repetitive, and applies to both decision-making (e.g., compliance/non-compliance with a standard) and estimation. The DQO process establishes performance and acceptance criteria that drive the plan for collecting data of sufficient quality and quantity to support the goals of the IH study(ies). The DQO process leads to efficient and effective expenditures of resources; consensus on the type, quality, and quantity of data needed to meet project goals; and full documentation of actions taken during project maturity.

The steps in the DQO process are as follows:

1. State the problem
2. Identify the goal(s) of the study
3. Identify information inputs
4. Define the study boundaries
5. Develop the analytic approach
6. Specify performance or acceptance criteria
7. Develop the plan for data acceptance

### 6.4.1 Problem Statement

On December 22, 2008, a coal ash release occurred at the KIF, allowing a large amount of coal ash to escape into the adjacent waters of the Emory River and surrounding land, releasing about 5.4 million cubic yards and covering about 300 acres.

The coal ash, a by-product of a coal-fired power plant, originates from coal burned in boilers for power production at the KIF. The coal, in its natural state, contains various metals that can be retained with the ash after burning. The ash itself is primarily composed of fine silica particles very similar to sand, but trace amounts of arsenic, selenium, cadmium, boron, thallium, beryllium, and other metals which occur naturally in the coal remain in the ash after coal combustion. These metals are typically bound to the ash.

In an effort to move the coal ash to its original location requires much heavy equipment capable of moving the ash. This equipment includes such items as excavators, dump trucks, dredges, scraper pans, etc. Therefore the activities require drivers, operators, and support laborers, or personnel that have the potential for exposures. Due to the potential inhalation hazards and the CERCLA designation, Hazardous Waste Operations and Emergency Response controls have been placed on the site.

### 6.4.2 Project Goals

The primary objectives for IH monitoring are to:

- Provide continuing confirmation that KIF-related constituents have not negatively affected the Kingston Ash Recovery Project site personnel's health by either acute (or single) or chronic (or repeated) exposures.
- Provide respiratory exposure data sufficient to substantiate efforts to minimize risk of adverse exposures are in place and effective for all individuals spanning all SEGs.
- Evaluate the effectiveness of best management practices (e.g., dust control, respiratory protection, etc.) in preventing or mitigating respiratory occupational exposures.

### 6.4.3 Information Inputs

The information necessary to achieve the objectives includes the following:

- Reoccurring and scheduled IH personal air monitoring.
- Analytical results of air monitoring for ash-related constituents.

### 6.4.4 Study Boundaries

Personal (industrial hygienic) air monitoring will be conducted on all SEGs:

- Identified as having a potential respiratory exposure to coal ash constituents.
- Supervisory requests of personnel having been evaluated by IH staff and verified as having potential exposures.

### 6.4.5 Analytic Approach

Coal ash contains numerous constituents that have been linked to adverse health effects in human receptors. Specific constituents of interest include silica, arsenic, selenium, beryllium among others. Analysis should be conducted by laboratories operating in accordance with the standards set forth by AIHA. Analysis should also be conducted based upon the associated methods identified by NIOSH.

### 6.4.6 Performance or Acceptance Criteria

The null hypothesis for personal IH air monitoring is: The percentage of coal ash constituents do not result in occupational respiratory health hazards to personnel working onsite. The alternative hypothesis is: The percentage of coal ash constituents result in occupational respiratory health hazards to personnel working onsite.

The null hypothesis for dust control is: Best Management Practices (BMPs) are completely adequate for controlling occupational exposures of ash-related contaminants during removal operations. The alternative hypothesis is: BMPs are not completely adequate for controlling occupational exposures of ash-related contaminants during removal operations.

### 6.4.7 Data Acceptance

Data acceptance is based on criteria established in Section 6.3.

## 6.5 QUALITY ASSURANCE / QUALITY CONTROL AND QUALITY ASSURANCE PROJECT PLAN (QAPP) CROSS WALK TABLES

Jacobs uses the NIOSH Analytical and Sampling Methods outlined in the *NIOSH Manual of Analytical Methods* (NMAM) in conjunction with best management IH practices acknowledged by: the ABIH, AIHA, ACGIH, and recommendations by AIHA certified laboratories to perform the air sampling conducted on the Kingston Ash Recovery Project site. NMAM is a collection of methods for sampling and analysis of contaminants in workplace air of workers who are occupationally exposed. These methods have been developed or adapted by NIOSH or its partners and have been evaluated according to established experimental protocols and performance criteria. NMAM also includes chapters on QA, sampling, portable instrumentation, etc. The methods used as described below in Table 6-1 can be found at: http://www.cdc.gov/niosh/docs/2003-154/

**Table 6-1**
**OSHA / NIOSH Analytical and Sampling Methods and Site Guidance Documents**

| Method/WI Number | Method/Document Title |
|---|---|
| NIOSH 0500 | Particulates not otherwise regulated, total 0500 |
| NIOSH 0600 | Particulates not otherwise regulated, respirable 0600 |
| NIOSH 7300 | Elements by ICP (nitric/perchloric acid ashing) 7300 |
| NIOSH 7500 | Silica, crystalline, by XRD (filter re-deposition) 7500 |
| HSE-07 | Industrial Hygiene Personal Air Monitoring Procedure |

**Table 6-2**
**Quality Assurance Project Plan Cross-Walk**

| QAPP Element | Location in SWSHP | Location in NIOSH Methods |
|---|---|---|
| Data Quality Objectives | Appendix K, Section 6.4, Data Quality Objectives | |
| IH Program Design | Appendix K, Section 2.0, Industrial Hygiene Process Overview | |
| Sampling Methods | Appendix K, Section 4.0, Chemical Hazard Monitoring Method; Section 2.1, Identification of Similar Exposure Groups; Table 2-1, Similar Exposure Groups Identified at the Kingston Ash Recovery Project Site | Applicable NIOSH Methods (e.g., 0500, 0600, 7300, 7500, etc.) |
| Sample Collection | HSE-07, Industrial Hygiene Personal Air Monitoring Procedure | |
| Data Review and Validation (QAPP Section 21.0 22.0) | Appendix K, Section 6.3, Data Validation | |
| Assessments and Response Actions (QAPP) | Appendix K, Section 2.4 Verify Upper Confidence Limits and Manage Further Monitoring; and Section 2.3 Document Control, Reporting, and Notification. | |

**Attachment 1**

**Sample Health Hazard Evaluation by Exposure Group (Form 124)**

| HEALTH HAZARD EVALUATION BY EXPOSURE GROUP | |
|---|---|
| Work Area: | |
| Exposure Group: | |
| Task(s): | |

| Contaminant or Agent | Exposure Probability | Health Effect Rating | Uncertainty Rating | Risk Rating | Month /Year to Monitor or Monitored | Applicable EL and Range of Results | Control Strategy Implemented |
|---|---|---|---|---|---|---|---|
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__Notes__:

This table to be completed using the standard approach outlined in Jacobs *HSEP 12.1*, *Health Hazard Evaluation*

EL = Exposure Level

KIF Form 124

**Attachment 2**

**Kingston Ash Recovery Site Industrial Hygiene Monitoring White Paper**

## Kingston Ash Recovery Site Industrial Hygiene Monitoring Whitepaper

January 24, 2013

### 1. Introduction

Since July 2010 exposure monitoring has been performed at TVA's Kingston Ash Recovery Project site by Jacobs. The objective of this monitoring was to evaluate potential exposures associated with ongoing work activities during clean-up and recovery operations. The monitoring was initiated at the onset of the clean-up response by EnSafe, Inc. EnSafe performed industrial hygiene support activities until the responsibility for the monitoring was passed to Jacobs in July 2010.

In keeping with recognized industrial hygiene practices, similar exposure groups (SEGs) were established by Jacobs and were monitored for contaminants that could exist in the work environments given the type of tasks being performing. Jacobs also reviewed the existing EnSafe data and when possible, incorporated their information into the appropriate Jacobs SEG data set. The overall objective of establishing SEGs was to characterize the exposure for each potential workplace air contaminant they may encounter. Each SEG was assigned 1 of 4 contaminant specific exposure characterization bands based on statistical analysis of their data set using a 95% confidence limit.

The following bands were used for exposure characterization for each contaminant within each SEG:

Band 1. <10% of the exposure limit
Band 2. ≥10% and <50% of the exposure limit
Band 3. ≥50% and <100% of the exposure limit
Band 4. ≥100% of the exposure limit

Per the *Site Wide Safety and Health Plan for the TVA Kingston Fossil Plant Ash Release Response*, there were several criteria established for cessation or reduction of air monitoring. These included:

- Achieve adequate exposure group characterization, generally to the 95% confidence level. An exposure group may be considered characterized when this confidence level is reached with the data set and is not dependent on the results being below the associated permissible exposure level (PEL).
- Change in process occurs or engineering controls implemented which effectively decreases monitoring levels to less than 25% of the associated PEL.
- Completion or cessation of the associated task or removal of the associated exposure group from the exposure environment.

### 2. Evaluation

Currently there are 8 SEGs active at the site:

- Drill Crew
- Hydroseed Crew

- Mechanic
- On-Land Laborer
- On-Land Operator
- Perimeter Wall Crew
- Site-wide Support Staff
- Teamster

Under the current sampling approach, weekly monitoring is being performed with at least two SEGs being monitored each week. However, as the attached data summary sheet demonstrates, with the exception of Mechanic and Perimeter Wall Crew SEGs, the probabilities for the remaining six SEGs indicate exposure levels represented by Band 2 as noted above (less than 50% of the exposure limit).

With the case of the Mechanic and Perimeter Wall Crew SEGs, the data indicates a well characterized exposure. Although exposure levels are somewhat higher, the exposures for these two SEGs fall in Band 3 of the table and are still less than the exposure limit. In both of these instances a reduction of monitoring frequency to quarterly is warranted. In the first instance, the data strongly demonstrates that exposures are inconsequential and are well characterized. In the second instance, the exposure groups are adequately characterized and appropriate controls are in place to minimize exposure to personnel. The quarterly sampling will be used to verify these conclusions are still valid.

## 3. Conclusion

Recommend changing the current sampling frequency to quarterly for all active SEGs onsite. The intent of the quarterly sampling is to verify that no significant change in process or operation has occurred and that current data assumptions are still valid.

| | | Probability of Exposure Against the Average Shift Adjusted OEL | | | | | |
|---|---|---|---|---|---|---|---|
| **SEG** | **Sample data Timeframe:*** | **Potential Exposure** | **< 10% of the EL** | **> 10% and < 50% of the EL** | **> 50% and < 100% of the EL** | **> 100% of the EL** | **Average Shift Adjusted OEL** |
| Drill Crew | To 9/27/12 | Respirable Particulate | 0.5 | 99.5 | | | 3.59 mg/m3 |
| | To 9/27/12 | Silica <LOD as LOD | | 95.4 | 4.6 | | 0.036 mg/m3 |
| Hydroseed Crew | To 9/27/12 | Respirable Particulate | 98 | 2 | | | 4.86 mg/m3 |
| | To 9/27/12 | Silica <LOD as LOD | | 99 | 1 | | 0.047 mg/m3 |
| Mechanic | To 9/27/12 | Respirable Particulate | 84.8 | 15.2 | | | 3.26 mg/m3 |
| | To 9/27/12 | Silica <LOD as LOD | | 92.3 | 7.6 | 0.1 | 0.034 mg/m3 |
| On-Land Laborer | To 9/27/12 | Respirable Particulate | 100 | | | | 3.68 mg/m3 |
| | To 9/27/12 | Silica <LOD as LOD | | 99.9 | 0.1 | | 0.036 mg/m3 |
| On-Land Operator | To 9/27/12 | Respirable Particulate | 100 | | | | 3.45 mg/m3 |
| | To 9/27/12 | Silica <LOD as LOD | | 99.7 | 0.3 | | 0.034 mg/m3 |
| Perimeter Wall Crew | To 9/27/12 | Respirable Particulate | | 8 | 92 | | 2.6 mg/m3 |
| | To 9/27/12 | Silica <LOD as LOD | | | 100 | | 0.026 mg/m3 |
| Site-wide Staff Support | To 9/27/12 | Respirable Particulate | 99.8 | 0.2 | | | 3.59 mg/m3 |
| | To 9/27/12 | Silica <LOD as LOD | | 99.8 | 0.2 | | 0.033 mg/m3 |
| Teamster | To 9/27/12 | Respirable Particulate | 99.9 | 0.1 | | | 3.4 mg/m3 |
| | To 9/27/12 | Silica <LOD as LOD | | 99.7 | 0.3 | | 0.035 mg/m3 |
| | | **Sample Frequency:** | Verify no change | Quarterly | Monthly | Routinely | |

Notes:
*Data included from July 2010 until date noted.
LOD- Limit of Detection = Method Detection Limit = A statistical estimate of method/media/instrument sensitivity.
EL- Exposure Limit
OEL- Occupational Exposure limit
All Metals screening results were less than 10% of the EL

Program:
IHDataAnalyst V1.27
Respirable particulate samples run with Default CDA method:
Substitution with LOD/2 when <LOD lab result.

Silica was run with Default CDA method:
No Substitution. Use LOD when <LOD lab result.

# EXHIBIT D

**ADDENDUM 1: Individualized Exposure Assessment of Greg Adkisson**

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by Greg Adkisson at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; and Theron Blickenstaff, MD.

**Materials Reviewed:**

With regard to Mr. Adkisson, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff Greg Adkisson's Responses to Interrogatories;
- Employment Records for Greg Adkisson;
- Personal Air Monitoring Data;
- October 6, 2020 Deposition of Donna Adkisson; and
- July 26, 2017 Deposition of Greg Adkisson.

**Greg Adkisson's Work at the Kingston Coal Ash Recovery Site:**

Union records indicate that Mr. Adkisson worked for GUBMK from December 2008 until March 2012. Mr. Adkisson estimates that he worked on the Kingston site from December 22, 2008 to March 2012. Mr. Adkisson work as an equipment operator, operating a track hoe and water pumps on the Kingston site during that period. He also "refueld the light plants" on the site. Mr. Adkisson was promoted to a foreman, which required him to drive and walk on and around the Kingston site to supervise workers throughout the site. Mr. Adkisson estimates that he regularly

worked up to seven days a week for approximately 12 hours per day, or more due to overtime, during the period from December 2008 to mid-February 2009, when he worked as an equipment operator. Mr. Adkisson estimates that he regularly worked thirteen days on, with two days off, for approximately twelve hours per day during the period from mid-February 2009 to March 2012, when he worked as a foreman.

**Sampling and Testing Relevant to Greg Adkisson's Work:**

Mr. Adkisson testified that he worked as an "equipment operator;" since there was no such SEG, it is likely that he worked in the following SEGs: Dozer Operator, Excavator Operator, Grader Operator, Scraper Pan Operator. He also worked as a Fuel Truck Operator. He worked as a foreman, adding the SEG Management/Administration. Finally, his work as a foreman required him to travel around the entire site, so the other site-wide support staff SEGs, i.e., Field Staff and Sample Technician, likely are relevant to his exposures. The highest measured concentrations in each of these SEGs are summarized in the table below.

| SEG and year | Total Dust (μg/m$^3$) | Resp. PM (μg/m$^3$) | Silica (μg/m$^3$) |
|---|---|---|---|
| Excavator Operator | | | |
| 2009 | 210 | 69 | |
| 2010 | 1400 | | |
| 2011 | | 690 | 18 |
| 2012 | | 520 | |
| 2013 | | 1100 | 7 |
| Dozer Operator | | | |
| 2009 | 1300 | 210 | 18 |
| 2010 | 930 | 58 | |
| 2011 | | 200 | 26 |
| 2012 | | 77 | |
| 2013 | | 61 | |
| Fuel Truck Operator | | | |
| 2011 | | 320 | 24 |
| Field Staff | | | |
| 2010 | | <44 | |
| 2011 | | 220 | 14 |
| 2012 | | 27 | |
| 2013 | | 77 | |

| | | | |
|---|---|---|---|
| 2014 | 180 | 47 | |
| Management/Admin | | | |
| 2009 | 290 | 67 | |
| Sample Technician | | | |
| 2010 | <190 | <134 | |
| 2011 | | 560 | 19 |
| 2012 | | 920 | 23 |

These measurements indicate very high exposures to these SEGs, in particular for Excavator Operator, Dozer Operator, and Sample Technician – which represent the range of different working conditions for Mr. Adkisson. The TPM measurements represent very high exposures to total particle mass, and the RPM measurements for the Excavators in 2011-2013 and Sample Technician in 2011-2012 are very high, approximately 50 – 100 times higher than the prevailing background $PM_{2.5}$ concentration, indicating a substantial exposure to airborne fly ash. The highest measured concentration for silica, a human carcinogen, exceeds the ACGIH TLV® of 25 $\mu g/m^3$. The measurements indicate that Mr. Adkisson received substantial exposures across all of his SEGs.

The fact that Mr. Adkisson worked significant overtime makes his substantial exposures even more serious; if, for example, he worked 80 hours per week rather than 40 it would have doubled his total dose from inhalation and ingestion and reduces the silica TLV® from 25 to 12.5 $\mu g/m^3$, and then 7 out of 8 of the silica measurements in the above table would have exceeded the TLV®.

In addition to the air sampling described above, we can look to indirect evidence for his exposures.

**Evidence of Greg Adkisson's Exposure:**

Mr. Adkisson has described his exposure to coal ash while working at the Kingston site. For example, in responding to interrogatories, he explained that there was so much coal ash at the

Kingston site that it caused his work truck, which was white, to look grey. He recalled that despite regular cleaning, the "inside of [his] truck was filthy . . . because there was also so much ash dust flying around in the air." He recalled that the coal ash was "constantly everywhere in the cab and on the dashboard," that he "always had to wipe off the dash with [his] hand so that [he] could see the gauges."

Mr. Adkisson explained that "[t]he air and the ground at Kingston and everything that came on to the site was always covered in coal ash." He stated that he could "smell" the coal ash, describing it as "musky." He stated, "The majority of the time, when the wind blew, I could not see 200 feet in front of me because so much ash was in the air. It was like a big cloud of ash was on top of the site." Mr. Adkisson explained that he could "see the [coal ash] particles in the air really well in the beams of light" at night. He recalled that the coal ash regularly covered his boots and came up to his ankles, or up to his knees at times when it rained. As he explained, when he was required to walk around the site as a foreman, "the ash covered [him] even more."

Mr. Adkisson stated that the "ash got all over [his] skin but also inside [his] ears, nose, mouth, and eyes." He recalled being able to "taste the ash," describing it as "gritty in [his] teeth." He recalled, "Whenever [he] blew [his] nose, a grey or black mucus came out. The same things happened when [he] coughed. [He] tried to clean out [his] nose every night, but it was too filled with ash. It actually took at least 4 cotton swabs in each nostril to clean my nose so that I could breathe out of it again." He further explained that, even though he wore safety glasses while working on the Kingston site, the coal ash "was so fine that it got in [his] eyes" and burned them and would require him to rinse them out regularly. He further recalled the coal ash being "all over" the workers' break rooms, and that the coal ash would get onto his food, even though he placed them in containers.

Mr. Adkisson explained that the coal ash "covered [his] clothes so bad that if [he] slapped them, [he] could see the dust fly off." He stated that if he wore short sleeves, he "could see the ash all over [his] arms." He recalled the coal ash getting under his fingernails as well. As he stated, "There was too much ash everywhere to be able to keep it off me." He recalled that there were boot washing stations on the site but that they were ineffective, leaving the workers with no means of cleaning the coal ash off their bodies and clothing.

When he returned home each day from working at the Kingston site, Mr. Adkisson would immediately take a shower "because [he] was so covered in ash." He recalled, "The black ashy water ran off [his] skin and hair every day in the shower. [He] could see the black water fill up the bathtub. It actually stained the bottom of [his] tub." He explained that his wife washed his dirty work clothes and that "[s]he often had to run them through two cycles" and had to run the empty washing machine between loads "to try to clean out the ash in the washer." During her deposition, Mr. Adkisson's wife, Donna Adkisson, explained that the coal ash would get into the washing machine. He recalled that they had to replace their washing machine because of the coal ash.

During his deposition, Mr. Adkisson testified that Tom Bock, a Jacobs Engineering Group, Inc. employee, stated that "you could eat a cup [of coal ash] a day and it wouldn't bother you." Mr. Adkisson testified that he personally asked "about every day" for a mask to wear on the Kingston site and was told that dust masks were not "allowed to [be] give[n] . . . out." He explained that masks were not allowed to be worn by workers at the Kingston site because "it throwed a red flag to the community" about the dangers of coal ash. He further testified that he was told: "[If e]verybody out there [was] wearing dust masks, it'd throw a red flag to the community and [management] didn't want that."

Based on the foregoing, it is my scientific opinion that Greg Adkisson, more likely than not, was exposed by inhalation and ingestion to a long-term, continuous, and high intensity dose of coal fly ash during his employment at the Kingston site sufficient to result in numerous negative health effects as supported by the scientific literature.

**<u>ADDENDUM 2: Individualized Exposure Assessment of Tim Bandy</u>**

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by Tim Bandy at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; and Theron Blickenstaff, MD.

**Materials Reviewed:**

With regard to Mr. Bandy, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff Tim Bandy's Responses to Interrogatories;
- Employment Records for Tim Bandy;
- Personal Air Monitoring Data; and
- August 12, 2020 Deposition of Tim Bandy.

**Tim Bandy's Work at the Kingston Coal Ash Recovery Site:**

Union records indicate that Mr. Bandy was employed by GUBMK from June 2011 through October 2011; by Environmental Barrier Co. LLC. from February 2012 through September 2013 and then again from November 2013 through December 2013; by GUBMK from September 2014 to October 2014; and by GEO Solutions from January 2014 through February 2014. Mr. Bandy estimates that he worked on the Kingston site from June 2011 to October 2011 and then again from February 2012 to February 2014. Mr. Bandy worked as a laborer, which required him to work on

the Kingston site during that period. Mr. Bandy estimates that he worked six days a week for approximately fifty per week, or more due to overtime, during this period.

**Sampling and Testing Relevant to Tim Bandy's Work:**

Based on his work history, Mr. Bandy worked in the General Laborer and BP_General Laborer SEGs, included below. The highest measured concentrations in each year in this SEG are shown in the following table.

| SEG and year | Total Dust (μg/m$^3$) | Resp. PM (μg/m$^3$) | Silica (μg/m$^3$) |
|---|---|---|---|
| General Laborer | | | |
| 2009 | 2000 | 570 | 49 |
| 2010 | 2500 | 440 | <9 |
| 2011 | | 190 | 21 |
| 2012 | | 96 | |
| 2013 | | 120 | 16 |
| 2014 | 480 | | |
| BP_General Laborer | | | |
| 2011 | | 2200 | 32 |
| 2012 | | 810 | 67 |
| 2013 | | 890 | |

These sample results indicate a repeated, substantial exposure to workers in Mr. Bandy's SEG. First consider the General laborer SEG. The TPM measurements in 2009 and 2010 are among the highest measurement in the entire data set and represent levels that are very difficult to create and maintain in an outdoor environment, since they are approximately 100 times higher than the ambient background TPM levels. The highest measured RPM concentration, 570 μg/m$^3$, is approximately fifty times higher than the likely ambient background $PM_{2.5}$ concentration, indicating a substantial exposure to airborne fly ash. The highest measured exposure to silica, a human carcinogen, 49 μg/m$^3$, is twice the ACGIH TLV® of 25 μg/m$^3$.

For the BP_General Laborer SEG, the RPM and silica measurements here represent consistent exposures over several years that are among the highest in the entire data set. Workers in this SEG were regularly exposed to the highest levels of airborne contaminants seen on site.

The fact that Mr. Bandy worked significant overtime makes his substantial exposures even more serious; if, for example, he worked 80 hours per week rather than 40 it would have doubled his total dose from inhalation and ingestion and reduces the silica TLV® from 25 to 12.5 $\mu g/m^3$, and then 5 of the 6 silica measurements in the above table would have exceeded the TLV®.

In addition to the air sampling described above, we can look to indirect evidence for his exposures.

**Evidence of Tim Bandy's Exposure:**

Mr. Bandy has described his exposure to coal ash while working at the Kingston site. For example, in responding to interrogatories, he explained that he was "directly involved" with the coal ash cleanup at the Kingston site. He further explained that he "walked all in the ash" and "was in the ash all day." He noted that he "backed out trucks and put walls in the ground." He described how the coal ash "got all over [him]." Despite this, Mr. Bandy did not wear a mask while working on the Kingston site.

Mr. Bandy testified that he worked in close proximity to the coal ash and that the wind would blow the coal ash into the area in which he was working on a regular basis. He explained that his personal vehicle was covered in coal ash. He noted that the coal ash covered his clothes. Further, when he returned home each day from working at the Kingston site, he would wash his clothes. He recalled that his washing machine broke because it washed his clothes that were covered in coal ash.

Based on the foregoing, it is my scientific opinion that Tim Bandy, more likely than not, was exposed by inhalation and ingestion to a long-term, continuous, and high intensity dose of coal fly ash during his employment at the Kingston site sufficient to result in numerous negative health effects as supported by the scientific literature.

**ADDENDUM 3: Individualized Exposure Assessment of William Harvey Bass, Jr.**

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by William Harvey Bass, Jr. at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; Carrie A. Redlich, MD, MPH; and Norman Latov, MD.

**Materials Reviewed:**

With regard to William Bass, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff William H. Bass's Responses to Interrogatories;
- Employment Records for William H. Bass;
- Personal Air Monitoring Data; and
- October 4, 2017 Deposition of William Harvey Bass, Jr.

**William Bass's Work at the Kingston Coal Ash Recovery Site:**

Union records indicate that William Bass was employed by GUBMK from December 26, 2008 to October 17, 2014. Mr. Bass estimates he worked on the Kingston site from December 28, 2008 to October 15, 2015. Mr. Bass worked as an operator, operating a bulldozer and other heavy equipment, which required him to work on the Kingston site during that period. Mr. Bass estimates that he worked up to seven days a week for approximately eight hours per day, or more due to overtime, during the early portion of this period.

**Sampling and Testing Relevant to William Bass's Work:**

Based on his work history, air sampling done for the SEGs Excavator Operator and Dozer Operator are relevant to Mr. Bass' work at the Kinston site. The highest measured concentrations in each SEG are summarized in the table below.

| SEG and year | Total Dust (μg/m$^3$) | Resp. PM (μg/m$^3$) | Silica (μg/m$^3$) |
|---|---|---|---|
| Excavator Operator | | | |
| 2009 | 210 | 69 | |
| 2010 | 1400 | | |
| 2011 | | 690 | 18 |
| 2012 | | 520 | |
| 2013 | | 1100 | 7 |
| 2014 | 240 | | |
| Dozer Operator | | | |
| 2009 | 1300 | 210 | 18 |
| 2010 | 930 | 58 | |
| 2011 | | 200 | 26 |
| 2012 | | 77 | |
| 2013 | | 61 | |

These measurements indicate very high exposures to these SEGs. The TPM measurements represent very high exposures to total particle mass, and the RPM measurements for the Excavators in 2011-2013 are very high, approximately 50 – 100 times higher than the prevailing background $PM_{2.5}$ concentration, indicating a substantial exposure to airborne fly ash. The highest measured concentration for silica, a human carcinogen, exceeds the ACGIH TLV® of 25 μg/m$^3$. The fact that Mr. Bass worked significant overtime makes his substantial exposures even more serious; if, for example, he worked 80 hours per week rather than 40 it would have doubled his total dose from inhalation and ingestion and reduces the silica TLV® from 25 to 12.5 μg/m$^3$, and then 3 of the 4 silica measurements in the above table would have exceeded the TLV®.

In addition to the air sampling described above, we can look to indirect evidence for his exposures.

**Evidence of William Bass's Exposure:**

Mr. Bass has described his exposure to coal ash while working at the Kingston site. For example, in responding to interrogatories, Mr. Bass stated that "[t]he site was as nasty as it could be." He explained that the coal ash would "get all over [him]." He further explained that it was "so dusty" at the Kingston site "that [he] couldn't see the other machines working at times." He recalled that the coal ash "would get on [his] food." As Mr. Bass testified during his deposition, after voicing concern, Tom Bock, a Jacobs Engineering Group, Inc. employee, reassured him and told him the coal ash was safe, even stating that he "can eat this stuff."

Mr. Bass recalled that his bulldozer "sank into coal ash" and that the coal ash "went all the way up to [his] door." When he opened the door, the coal ash came inside the bulldozer. When he climbed out of the bulldozer, he stated that he "was covered all in the ash."

Mr. Bass recalled that he had to sweep coal ash out of his machine when he would first arrive at the Kingston site each morning to work. As he testified, his bulldozer "was as nasty as it could be from just sitting there all night." Even though his bulldozer's cab was mostly enclosed, he stated that the inside was nevertheless covered in coal ash. As he testified, when he turned the bulldozer on, the "machine would rattle and dust would fly out of it everywhere out of the dash and stuff." He further explained that he "had to wipe the windows all throughout the day or else I could not see because the dust was so thick on it." Mr. Bass recalled that the air filter used to service his bulldozer's cab was changed "once or twice a year maybe," which was insufficient because he "could kick the dash . . . and [the coal ash] would cover you."

Mr. Bass stated that when he returned home each day following his work at the Kingston site, "[he] was covered in coal ash." He explained that even though there were boot washing stations at the Kingston site, "the water was disgusting" and would not clean the boots, but instead

"just smear" the coal ash. He stated that his washing machine had to be replaced, because his clothes were regularly covered in coal ash when washed. He also recalled that the "[i]nside and outside of [his] case was covered in the ash." As he described it, even though his car was white, "it would look grey."

Based on the foregoing, it is my scientific opinion that William Bass, more likely than not, was exposed by inhalation and ingestion to a long-term, continuous, and high intensity dose of coal fly ash during his employment at the Kingston site sufficient to result in numerous negative health effects as supported by the scientific literature.

**ADDENDUM 4: Individualized Exposure Assessment of Dustin Berry**

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by Dustin Berry at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; and Theron Blickenstaff, MD.

**Materials Reviewed:**

With regard to Mr. Berry, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff Dustin Berry's Responses to Interrogatories;
- Employment Records for Dustin Berry;
- Personal Air Monitoring Data; and
- January 25, 2017 Deposition of Dustin Berry.

**Dustin Berry's Work at the Kingston Coal Ash Recovery Site:**

Union records indicate that Mr. Berry was employed by GUBMK in November 2009 and from February to August in 2010. Union records also indicate that Mr. Berry was employed by GUBMK from February 2012 to August 2013. Mr. Berry estimates he worked on the Kingston site "on and off" from November 2009 to June 2014. Mr. Berry worked as a truck driver, driving an Rtech dump truck during the day shift and a water truck during the night shift on and around the Kingston site during that period. Mr. Berry estimates that he regularly worked up to seven days

a week for approximately twelve hours per day, due to overtime, during this period from November 2009 to August 2013.

**Sampling and Testing Relevant to Dustin Berry's Work:**

Based on his work history, sampling collected in the following SEGs is relevant to Mr. Berry: Articulated Dump Truck Operator, Water Truck Operator. The highest measured concentrations in each SEG are summarized in the table below.

| SEG and year | Total Dust (μg/m$^3$) | Resp. PM (μg/m$^3$) | Silica (μg/m$^3$) |
|---|---|---|---|
| Artic Dump Truck Operator | | | |
| 2009 | 390 | 260 | 13 |
| 2010 | 350 | <42 | <8 |
| 2011 | | 200 | 17 |
| 2012 | | 120 | 13 |
| 2013 | | 62 | |
| 2014 | 200 | | |
| Water Truck Operator | | | |
| 2009 | 170 | | |
| 2010 | 380 | 109 | |
| 2011 | | 320 | 24 |
| 2012 | | 150 | 10 |
| 2013 | | 280 | |
| 2014 | | 58 | |

These sample results indicate a repeated, substantial exposure to workers in Mr. Berry's SEGs. The highest measured RPM concentration, 320 μg/m$^3$, is approximately thirty times higher than the likely ambient background $PM_{2.5}$ concentration, indicating a substantial exposure to airborne fly ash. The highest measured exposure to silica, a human carcinogen, 24 μg/m$^3$, is just slightly below the ACGIH TLV® of 25 μg/m$^3$. The fact that Mr. Berry worked significant overtime makes his substantial exposures even more serious; if, for example, he worked 80 hours per week rather than 40 it would have doubled his total dose from inhalation and ingestion and reduces the silica TLV® from 25 to 12.5 μg/m$^3$, and then 5 of the 6 silica measurements in the above table would have exceeded the TLV®.

In addition to the air sampling described above, we can look to indirect evidence for his exposures.

**Evidence of Dustin Berry's Exposure:**

Mr. Berry has described his exposure to coal ash while working at the Kingston site. For example, in responding to interrogatories, he was regularly "covered head to toe in coal ash" and that "coal ash was always floating around" the Kingston site. According to Mr. Berry, "[t]he ash made the [Kingston] site look like it was covered in a dust cloud." He explained that his job at the Kingston site required him to drive through "the dustiest places" and that the coal ash got all over his clothes, hair, and skin. He explained that he was required to "spray[] the water beside the air monitors while laborers worked in the area . . . to keep the dusty ash from setting off the air monitors."

Mr. Berry reported that the coal ash regularly got "all over" him at the Kingston site, including "all over [his] clothes, hair, and skin" and even "in [his] nose, ears, and mouth." He recalled being able to taste the coal ash in his mouth, and he described it as being "gritty on [his] teeth." He stated that he "often felt like [he] was eating dust when [he] was at Kingston."

Mr. Berry explained that his truck on the Kingston site was "covered in coal ash." He described how "[t]he ash settled all on the outside of the truck but also got into the cab through the window and air vents." As he described it, "[a]sh covered the floorboard at least an inch deep." He recalled being unable to remove all the coal ash from inside his truck because "[n]o matter how much [he] tried to wipe out the cab, the dusty ash got all over everything in no time." Mr. Berry explained that the coal ash was "all over the steering wheel, seats, dashboard, and windshield," and he would have "to wipe it off often in order to see the gauges on the dashboard and through

the windshield." He further testified during his deposition that there would be so much coal ash inside his truck that he "could slap the seat and . . . a cloud of dust would come up."

Mr. Berry stated that he "was not able to protect [him]self from the fly ash" while on Kingston site because the workers "could not wear masks at Kingston because of public perception." He testified that Kevin Thompson, another worker at the Kingston site, was "laid . . . off over [asking for a dust mask]." As he stated, masks were not given to the workers, and "once they found [a worker] that was going to come [to the site] and was going to wear one, as soon as they found that out he was gone."

Although the Kingston site had boot washing stations, Mr. Berry explained that they were "not effective after one or two workers used them." He recalled that "[t]he ash was still all over [him] at the end of the work day when [he] got into [his] personal car." He stated that "[t]he ash from my boots and clothes fell off in my personal car." As a result, he explained that he brought his clothing and belongings home covered in ash. Mr. Berry stated that he "was not warned about the dangers of coal ash" at any point.

Based on the foregoing, it is my scientific opinion that Dustin Berry, more likely than not, was exposed by inhalation and ingestion to a long-term, continuous, and high intensity dose of coal fly ash during his employment at the Kingston site sufficient to result in numerous negative health effects as supported by the scientific literature.

**ADDENDUM 5: Individualized Exposure Assessment of Gabriel Shane Billingsley**

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by Gabriel Shane Billingsley at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; and Theron Blickenstaff, MD.

**Materials Reviewed:**

With regard to Mr. Billingsley, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff Gabriel Billingsley's Responses to Interrogatories;
- Employment Records for Gabriel Billingsley;
- Personal Air Monitoring Data; and
- August 11, 2017 Deposition of Gabriel Billingsley.

**Gabriel Billingsley's Work at the Kingston Coal Ash Recovery Site:**

Union records indicate that Mr. Billingsley was employed by GUBMK from January 2009 to August 2009 and from February 2010 to December 2013. Mr. Billingsley estimates he worked on the Kingston site "off and on" from August 2009 to December 2013. Mr. Billingsley worked as a truck driver, driving water trucks, vacuum trucks, and dump trucks on and around the Kingston site during that period. Mr. Billingsley estimates that he regularly worked up to seven days a week for approximately twelve hours per day, or more due to overtime, during this period.

**Sampling and Testing Relevant to Gabriel Billingsley's Work:**

Based on his work history, sampling collected in the following SEGs is relevant to Mr. Billingsley: Articulated Dump Truck Operator, Dump Truck Operator, Vacuum Truck Operator, Water Truck Operator. The highest measured concentrations in each SEG are summarized in the table below.

| SEG and year | Total Dust (μg/m$^3$) | Resp. PM (μg/m$^3$) | Silica (μg/m$^3$) |
|---|---|---|---|
| Artic Dump Truck Operator | | | |
| 2009 | 390 | 260 | 13 |
| 2010 | 350 | <42 | <8 |
| 2011 | | 200 | 17 |
| 2012 | | 120 | 13 |
| 2013 | | 62 | |
| 2014 | 200 | | |
| Dump Truck Operator | | | |
| 2009 | 360 | 260 | 13 |
| 2010 | | 95 | |
| 2011 | | 51 | |
| 2012 | | 36 | |
| Vacuum Truck Operator | | | |
| 2009 | | 110 | 30 |
| 2012 | | 52 | |
| Water Truck Operator | | | |
| 2009 | 170 | | |
| 2010 | 380 | 109 | |
| 2011 | | 320 | 24 |
| 2012 | | 150 | 10 |
| 2013 | | 280 | |
| 2014 | | 58 | |

These sample results indicate a repeated, substantial exposure to workers in Mr. Billingsley's SEGs. The highest measured RPM concentration, 320 μg/m$^3$, is approximately thirty times higher than the likely ambient background $PM_{2.5}$ concentration, indicating a substantial exposure to airborne fly ash. The highest measured exposure to silica, a human carcinogen, 30 μg/m$^3$, exceeds the ACGIH TLV® of 25 μg/m$^3$. The fact that Mr. Billingsley worked significant overtime makes his substantial exposures even more serious; if, for example, he worked 80 hours

per week rather than 40 it would have doubled his total dose from inhalation and ingestion and reduces the silica TLV® from 25 to 12.5 $\mu g/m^3$, and then 6 of the 8 silica measurements in the above table would have exceeded the TLV®.

In addition to the air sampling described above, we can look to indirect evidence for his exposures.

**Evidence of Mr. Billingsley's Exposure:**

Mr. Billingsley has described his exposure to coal ash while working at the Kingston site. For example, in responding to interrogatories, he explained that the Kingston site "was always covered" in fly ash, which is also called coal ash. He stated that the dry ash "kicked up into the air so much that [he] could see it floating around in the air." As he put it, "the ash was everywhere and covered everything." He explained that the coal ash got "all over" his clothes, boots, skin, and hair. He explained that the coal ash would regularly collect on his face and he "could feel it in [his] nose, ears, eyes, and mouth" and would even "get into [his] food and drink." He stated that he "could taste" the coal ash, which he described as having "a metallic taste to it."

According to Mr. Billingsley, the ash got "all over the outside and inside of [his] truck." He stated that his truck was "always dirty no matter how much [he] tried to clean it" due to the coal ash constantly settling on it. He explained that the inside of his truck also regularly covered in ash, because the ash entered "through the window and vents because it was so thick in the air." He stated that the coal ash settled "on the floor, seats, dashboard, and windshield" and he would have to "wipe it off in order to see."

Mr. Billingsley recalled returning home each day after working at the site, carrying the coal ash "with [him] on [his] clothes everywhere when [he] left the [Kingston] site." He explained that

"the ash was all over [him] and it got in [his] personal car." Mr. Billingsley recalled that he and his wife had to replace their washing machine, because they washed his ash-covered clothes in it.

During his deposition, Mr. Billingsley testified that he was told by management at the Kingston site that coal ash was safe to eat. He further testified that "it was understood that the dust masks were not welcomed on the [Kingston] site." He recalled that Kevin Thompson, another worker on the Kingston site, was fired because he was "speaking up about his health issues." Mr. Billingsley also recalled another worker, John Cox, being denied the opportunity to wear a mask while working at the Kingston site. Mr. Billingsley stated that he never wore a mask while working at the Kingston site, because "dust masks would not be welcome on the site." As he put it, a worker "would not have been allowed to get off the bus in a dust mask."

Based on the foregoing, it is my scientific opinion that Gabriel Billingsley, more likely than not, was exposed by inhalation and ingestion to a long-term, continuous, and high intensity dose of coal fly ash during his employment at the Kingston site sufficient to result in numerous negative health effects as supported by the scientific literature.

**ADDENDUM 6: Individualized Exposure Assessment of Leonard Ronald Bledsoe**

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by Leonard Ronald Bledsoe at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; Eugene Shostack, MD; and Sanjay Rajagopalan, MD.

**Materials Reviewed:**

With regard to Leonard Bledsoe, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff Leonard Bledsoe's Responses to Interrogatories;
- Employment Records for Leonard Bledsoe;
- Personal Air Monitoring Data;
- September 11, 2020 Deposition of Julie Bledsoe; and
- September 25, 2017 Deposition of Leonard Ronald Bledsoe.

**Leonard Bledsoe's Work at the Kingston Coal Ash Recovery Site:**

Union records indicate that Leonard Bledsoe was employed by GUBMK in December 2008 to June 2008 and from January 2009 to August 2012. Leonard Bledsoe worked on the Kingston site from December 2008 to June 2012. Mr. Bledsoe was originally contacted on the day of the coal ash spill. Mr. Bledsoe held various jobs at the Kingston site. Mr. Bledsoe drove a dump truck "hauling coal ash out of the ponds." Mr. Bledsoe also drove a water truck, which required him to drive around the Kingston site and "walk[] all over the wet and dry ash" on the site. Mr.

Bledsoe also worked on the barges on the Kingston site, which required him to "unload[] the barges coming in and out of the lake" and he would typically haul away what was unloaded. Mr. Bledsoe estimates that he worked up to seven days a week for approximately eight hours per day, or more due to overtime, from December 2008 to "the end of 2010."

**Sampling and Testing Relevant to Leonard Bledsoe's Work:**

Based on his work history, sampling collected in the following SEGs is relevant to Mr. Bledsoe: Articulated Dump Truck Operator, Dump Truck Operator, Water Truck Operator. The highest measured concentrations in each SEG are summarized in the table below.

| SEG and year | Total Dust (μg/m$^3$) | Resp. PM (μg/m$^3$) | Silica (μg/m$^3$) |
|---|---|---|---|
| Artic Dump Truck Operator | | | |
| 2009 | 390 | 260 | 13 |
| 2010 | 350 | <42 | <8 |
| 2011 | | 200 | 17 |
| 2012 | | 120 | 13 |
| 2013 | | 62 | |
| 2014 | 200 | | |
| Dump Truck Operator | | | |
| 2009 | 360 | 260 | 13 |
| 2010 | | 95 | |
| 2011 | | 51 | |
| 2012 | | 36 | |
| Water Truck Operator | | | |
| 2009 | 170 | | |
| 2010 | 380 | 109 | |
| 2011 | | 320 | 24 |
| 2012 | | 150 | 10 |
| 2013 | | 280 | |
| 2014 | | 58 | |

These sample results indicate a repeated, substantial exposure to workers in Mr. Bledsoe's SEGs. The highest measured RPM concentration, 320 μg/m$^3$, is approximately thirty times higher than the likely ambient background $PM_{2.5}$ concentration, indicating a substantial exposure to airborne fly ash. The highest measured exposure to silica, a human carcinogen, 24 μg/m$^3$, is just

slightly below the ACGIH TLV® of 25 μg/m$^3$. The fact that Mr. Bledsoe worked significant overtime makes his substantial exposures even more serious; if for example he worked 80 hours per week rather than 40 it would have doubled his total dose from inhalation and ingestion and reduces the silica TLV® from 25 to 12.5 μg/m$^3$, and then 5 of the 7 silica measurements in the above table would have exceeded the TLV®.

In addition to the air sampling described above, we can look to indirect evidence for his exposures.

**Evidence of Leonard Bledsoe's Exposure:**

Mr. Bledsoe has described his exposure to coal ash while working at the Kingston site. Further, his spouse, Julie Bledsoe, has also described her observations of Mr. Bledsoe returning from work at the Kingston site, which represent additional evidence of his exposure to coal ash. For example, in responding to interrogatories, Mr. Bledsoe described his initial impressions of the Kingston site as "it looked like a bomb had exploded" because "it was so covered in ash." He recalled that "[i]n the morning, there were very bad dust storms" that would blow ash around the Kingston site and into the air.

Mr. Bledsoe recalled that there was "so much fly ash in the air." He regularly would eat his lunch in his truck, but he recalled that "ash got on [his] food and drinks] regardless. Mr. Bledsoe explained that the workers were provided baby wipes to remove the coal ash from their bodies and clothing, but he recalled that "they did not work well enough to remove the ash."

Mr. Bledsoe recalled that his truck and other trucks on the Kingston site were "covered in ash on the outside and inside." He stated that "[t]he trucks were yellow and white, but they were so covered in ash that they looked grey." He attempted to clean out the trucks throughout the day.

Following his shift, he would "swe[ep] the floors and wipe[] the cab down, but the next morning there was usually still a film of ash all over the cab."

Mr. Bledsoe stated that coal ash got "all over" him, "in [his] hair, nose, mouth, ears and all over [his] skin." He stated that the coal ash would cover his exposed skin so much that it "looked like [he] had a 'farmer's tan,' but it was due to the ash." He recalled cleaning out his ears, removing "dark grey" material. Further, when he blew his nose, "[g]rey mucus came out," which had "clumps of grey all in it." He stated that "[t]he coal ash got all in my fingernails" and "stained my cuticles and in the cracks of my fingernails." He noticed that scrubbing his hands and fingers with a brush could not remove the coal ash.

Mr. Bledsoe explained that stations were created for workers to wash their boots on the Kingston site, but that they "did not effectively clean our boots" and the "water was full of the ash." Mr. Bledsoe also recalled that some workers work shiny, yellow jackets, but that "the jackets would get so dirty that the yellow was quite faded." He recalled that Jacobs Engineering Group, Inc. provided the workers with these jackets, but refused to provide the workers with masks. In fact, Mr. Bledsoe testified in his deposition that early on, he wore a mask at the Kingston site and was told, "I wouldn't be seen with that mask on." Mr. Bledsoe further explained that he asked about wearing a mask and was told, "'Well, you don't want to start wearing them masks. They'll fire you.'"

Mr. Bledsoe stated that when he returned home each evening from working at the Kingston site, he "was still covered in a film of ash." He typically removed his boots before entering the house and noted that the ash from the boots "left a mark on the floor." He further recalled that the ash was "so fine that it was like baby pow[d]er and would get into the fibers of [his] clothes."

Mr. Bledsoe's spouse, Julie Bledsoe, testified that she regularly greeted Mr. Bledsoe when he returned home from working at the Kingston site. She noted that she "would kiss him hello at the door," and could taste the coal ash on him, which she characterized as a "weird taste in his mouth." She stated that the coal ash "was in his mouth [and] was in his saliva." Ms. Bledsoe further explained that she noticed coal ash in Mr. Bledsoe's beard and mustache and "all over his clothing." She recalled that Mr. Bledsoe was never given a mask or respirator while he worked at the Kingston site. She stated that "[h]is skin, every day, was covered" in coal ash.

Based on the foregoing, it is my scientific opinion that Leonard Bledsoe, more likely than not, was exposed by inhalation and ingestion to a long-term, continuous, and high intensity dose of coal fly ash during his employment at the Kingston site sufficient to result in numerous negative health effects as supported by the scientific literature.

**ADDENDUM 7: Individualized Exposure Assessment of Carl Booker**

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by Carl Booker at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; Eugene Shostak, MD; and Sanjay Rajagopalan, MD.

**Materials Reviewed:**

With regard to Mr. Booker, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff Carl Booker's Responses to Interrogatories;
- Personal Air Monitoring Data; and
- July 26, 2017 Deposition of Carl Booker.

**Carl Booker's Work at the Kingston Coal Ash Recovery Site:**

Mr. Booker estimates that he worked on the Kingston site from September 2009 to 2013. Mr. Booker worked as a truck driver, which required him to drive on and around the Kingston site during that period. He drove a variety of trucks, including a haul truck, a water truck, an articulated dump truck, and a school bus on and around the Kingston site. During this period, he worked both on the night shift and the day shift. Mr. Booker estimates that he worked up to seven days a week for approximately twelve hours per day, or more due to overtime, during this period from September 2009 to 2013.

**Sampling and Testing Relevant to Carl Booker's Work:**

Based on his work history, sampling collected in the following SEGs is relevant to Mr. Booker: Articulated Dump Truck Operator, Dump Truck Operator, Water Truck Operator. The highest measured concentrations in each SEG are summarized in the table below.

| SEG and year | Total Dust (μg/m$^3$) | Resp. PM (μg/m$^3$) | Silica (μg/m$^3$) |
|---|---|---|---|
| Artic Dump Truck Operator | | | |
| 2009 | 390 | 260 | 13 |
| 2010 | 350 | <42 | <8 |
| 2011 | | 200 | 17 |
| 2012 | | 120 | 13 |
| 2013 | | 62 | |
| 2014 | 200 | | |
| Dump Truck Operator | | | |
| 2009 | 360 | 260 | 13 |
| 2010 | | 95 | |
| 2011 | | 51 | |
| 2012 | | 36 | |
| Water Truck Operator | | | |
| 2009 | 170 | | |
| 2010 | 380 | 109 | |
| 2011 | | 320 | 24 |
| 2012 | | 150 | 10 |
| 2013 | | 280 | |
| 2014 | | 58 | |

These sample results indicate a repeated, substantial exposure to workers in Mr. Booker's SEGs. The highest measured RPM concentration, 320 μg/m$^3$, is approximately thirty times higher than the likely ambient background $PM_{2.5}$ concentration, indicating a substantial exposure to airborne fly ash. The highest measured exposure to silica, a human carcinogen, 24 μg/m$^3$, is just slightly below the ACGIH TLV® of 25 μg/m$^3$. The fact that Mr. Booker worked significant overtime makes his substantial exposures even more serious; if, for example, he worked 80 hours per week rather than 40 it would have doubled his total dose from inhalation and ingestion and

reduces the silica TLV® from 25 to 12.5 μg/m$^3$, and then 5 of the 7 silica measurements in the above table would have exceeded the TLV®.

In addition to the air sampling described above, we can look to indirect evidence for his exposures.

**Evidence of Carl Booker's Exposure:**

Mr. Booker has described his exposure to coal ash while working at the Kingston site. For example, in responding to interrogatories, he explained that coal ash was "always all over [him]" at the Kingston site and that he "could not keep it from getting everywhere." He explained that while working at night, the Kingston site "was very sloppy and muddy," as everything was covered in wet ash. He explained that during the day, he "could see the ash in the air" and that it "looked like really tiny dust bits."

Mr. Booker recalled that "[e]verything was covered in coal ash on the [Kingston] site." Mr. Booker noted that this included in the break rooms, where he and other workers at their meals. He stated, "It was so covered in ash inside the break rooms that I had to wipe the table off to be able to sit down and eat." He added that "[t]he ash got on [his] food."

Likewise, Mr. Booker explained that the trucks on the Kingston site were "dirty on the inside and outside." He noted that "[t]he dry ash from the air and the wet ash from the ground covered the trucks." He stated that coal ash "got all over the cab including on the dash, seats, and floorboards." He explained during his deposition that during the night shift, a crew would vacuum coal ash out of the interiors of the trucks, but coal ash remained in the vehicles.

Mr. Booker explained that the coal ash "was always all over" him while on the Kingston site. He explained that coal ash "got in [his] mouth," that he could taste the ash on the site because it was gritty in [his] mouth," and that the coal ash "got in [his] ears too." Mr. Booker stated that

when he cleaned his fingers, "black stuff would come out." He recalled that he "was always sneezing and coughing on the site" and when he blew his nose, "[his] mucus was grey."

Mr. Booker stated that the coal ash "got all over [his] clothes, skin, and hair." He explained that when he took a shower following his work at the Kingston site, "the water would be murky." He recalled that his wife "had to clean the shower after [he] was done because [he] got it so dirty."

Based on the foregoing, it is my scientific opinion that Carl Booker, more likely than not, was exposed by inhalation and ingestion to a long-term, continuous, and high intensity dose of coal fly ash during his employment at the Kingston site sufficient to result in numerous negative health effects as supported by the scientific literature.

**ADDENDUM 8: Individualized Exposure Assessment of Jeffrey Brewer**

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by Jeffrey Brewer at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; and Theron Blickenstaff, MD.

**Materials Reviewed:**

With regard to Mr. Brewer, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff Jeffrey Dwight Brewer's Responses to Interrogatories;
- Employment Records for Jeffrey Brewer;
- Personal Air Monitoring Data Collected; and
- April 11, 2017 Deposition of Jeffrey Dwight Brewer.

**Jeffrey Brewer's Work at the Kingston Coal Ash Recovery Site:**

Union records indicate that Jeff Brewer was employed by GUBMK from March 2010 to August 2014. Mr. Brewer estimates that he worked on the Kingston site from March 2010 to August 2014. Mr. Brewer worked as a truck driver, driving an articulated dump truck, a tandem dump truck, a flatbed truck, a fuel truck, a water truck, and a "low boy" on and around the Kingston site during that period. Mr. Brewer estimates that he regularly worked up to seven days a week for approximately twelve hours per day, or more due to overtime, during this period from March 2010 to August 2014.

**Sampling and Testing Relevant to Jeffrey Brewer's Work:**

Based on his work history, sampling collected in the following SEGs is relevant to Mr. Brewer: Articulated Dump Truck Operator, Dump Truck Operator, Fuel Truck Operator, Water Truck Operator. Fuel truck operators were only monitored in 2011 and 2012. The highest measured concentrations in each SEG are summarized in the table below.

| SEG and year | Total Dust (μg/m$^3$) | Resp. PM (μg/m$^3$) | Silica (μg/m$^3$) |
|---|---|---|---|
| Artic Dump Truck Operator | | | |
| 2009 | 390 | 260 | 13 |
| 2010 | 350 | <42 | <8 |
| 2011 | | 200 | 17 |
| 2012 | | 120 | 13 |
| 2013 | | 62 | |
| 2014 | 200 | | |
| Dump Truck Operator | | | |
| 2009 | 360 | 260 | 13 |
| 2010 | | 95 | |
| 2011 | | 51 | |
| 2012 | | 36 | |
| Fuel Truck Operator | | | |
| 2011 | | 320 | 24 |
| 2012 | | 38 | |
| Water Truck Operator | | | |
| 2009 | 170 | | |
| 2010 | 380 | 109 | |
| 2011 | | 320 | 24 |
| 2012 | | 150 | 10 |
| 2013 | | 280 | |
| 2014 | | 58 | |

These sample results indicate a repeated, substantial exposure to workers in Mr. Brewer's SEGs. The highest measured RPM concentration, 320 μg/m$^3$, measured for both his work as fuel truck and water truck driver, is approximately thirty times higher than the likely ambient background $PM_{2.5}$ concentration, indicating a substantial exposure to airborne fly ash. The highest measured exposure to silica, a human carcinogen, 24 μg/m$^3$, again measured for two of his jobs,

is just slightly below the ACGIH TLV® of 25 μg/m$^3$. The fact that Mr. Brewer worked significant overtime makes his substantial exposures even more serious; if, for example, he worked 80 hours per week rather than 40 it would have doubled his total dose from inhalation and ingestion and reduces the silica TLV® from 25 to 12.5 μg/m$^3$, and then 6 of the 8 silica measurements in the above table would have exceeded the TLV®.

In addition to the air sampling described above, we can look to indirect evidence for his exposures.

**Evidence of Jeffrey Brewer's Exposure:**

Mr. Brewer has described his exposure to coal ash while working at the Kingston site. For example, in responding to interrogatories, he explained that fly ash, also called coal ash, was "all over" him at the Kingston site and that, when stepped on, the coal ash "would puff up like baby powder." He said that "the wind would blow [the coal ash] everywhere" and he "could not even see the water truck from the dust blowing in the air." Mr. Brewer explained that the "ash was everywhere" and was even outside the exclusion zone, in designated "clean zones" on the Kingston site.

Mr. Brewer recalled there being "grey ash on the dash and steering wheel" of his truck each morning. Despite cleaning off the coal ash, the truck "would get covered again." He explained that "[t]he ash was so fine that it would seep through everything." Mr. Brewer recalled that, when he ate lunch, "the ash would get on [his] food." He also explained that there was "no place to wash [y]our hands" to clean off the coal ash.

Mr. Brewer explained that he was still covered in coal ash when he returned home each day from working at the Kingston site. He stated that he would regularly come home and give his daughters and his wife a hug. However, he then noticed that his "wife kept [getting] sinus

infections" throughout the time he worked at the Kingston site. After speaking with another worker, Billy Gibson, whose wife also was regularly sick, Mr. Brewer noticed "the dust and the ash in [his] clothes." After regularly washing his work clothes at home, he had to replace his washing machine twice.

In his deposition, Mr. Brewer testified that workers at the Kingston site were not allowed to wear masks on the site. As he put it, workers "could not wear a dust mask on that job, period." He recalled Tom Bock, a Jacobs Engineering Group, Inc. employee, removed masks from the Kingston site that had been stored in a trailer. Mr. Brewer recalled some workers wearing masks while weed eating on the site, but they were required to remove their masks. Mr. Brewer recalled other workers, Ansol Clark and Mike McCarthy, asking Chris Eich, another Jacobs Engineering Group, Inc. employee, if they could wear a dust mask. Mr. Brewer testified that Mr. Eich explicitly told them that they could not wear masks. As Mr. Brewer described, workers who wore a mask on the Kingston site would get fired.

Based on the foregoing, it is my scientific opinion that Jeffrey Brewer, more likely than not, was exposed by inhalation and ingestion to a long-term, continuous, and high intensity dose of coal fly ash during his employment at the Kingston site sufficient to result in numerous negative health effects as supported by the scientific literature.

**ADDENDUM 9: Individualized Exposure Assessment of Johnny Church**

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by Johnny Church at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; and Theron Blickenstaff, MD.

**Materials Reviewed:**

With regard to Mr. Church, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff Johnny Church's Responses to Interrogatories;
- Employment Records for Johnny Church;
- Personal Air Monitoring Data; and
- April 19, 2017 Deposition of Johnny Church.

**Johnny Church's Work at the Kingston Coal Ash Recovery Site:**

Union records indicate that Mr. Church was employed by GUBMK from September 25, 2009 to November 20, 2009 and from January 15, 2010 to April 2, 2012. Mr. Church estimates that he worked on the Kingston site from September 2009 to March 2012. Mr. Church worked as a laborer, which required him to work on the Kingston site during that period. Mr. Church estimates that he regularly worked up to seven days a week for approximately twelve hours per day, or more due to overtime during this period from September 2009 through March 2012.

**Sampling and Testing Relevant to Mr. Church's Work:**

Based on his work history, Mr. Church worked in the General Laborer SEG. The highest measured concentrations in each year in this SEG are shown in the following table.

| SEG and year | Total Dust (μg/m$^3$) | Resp. PM (μg/m$^3$) | Silica (μg/m$^3$) |
|---|---|---|---|
| General Laborer | | | |
| 2009 | 2000 | 570 | 49 |
| 2010 | 2500 | 440 | <9 |
| 2011 | | 190 | 21 |
| 2012 | | 96 | |
| 2013 | | 120 | 16 |
| 2014 | 480 | | |

These sample results indicate a repeated, substantial exposure to workers in Mr. Church's SEG. The TPM measurements in 2009 and 2010 are among the highest measurement in the entire data set and represent levels that are very difficult to create and maintain in an outdoor environment, since they are approximately 100 times higher than the ambient background TPM levels. The highest measured RPM concentration, 570 μg/m$^3$, is approximately fifty times higher than the likely ambient background $PM_{2.5}$ concentration, indicating a substantial exposure to airborne fly ash. The highest measured exposure to silica, a human carcinogen, 49 μg/m$^3$, is twice the ACGIH TLV® of 25 μg/m$^3$. The fact that Mr. Church worked significant overtime makes his substantial exposures even more serious; if, for example, he worked 80 hours per week rather than 40 it would have doubled his total dose from inhalation and ingestion and reduces the silica TLV® from 25 to 12.5 μg/m$^3$, and then 3 of the 4 silica measurements in the above table would have exceeded the TLV®.

As discussed below, Mr. Church apparently wore what he referred to as a mask, which most likely was a filtering facepiece respirator, on at least some days while working on the Kingston site. Based upon his testimony, it does not appear that Mr. Church wore a NIOSH-

approved half-mask respirator, as he stated he wore "only a face shield and dust mask." Mr. Church explained, however, that "[t]he face shield and dust mask did not help protect [him] from coal ash" and that he "would always have [coal ash] on [his] face and around [his] mouth." Even if he wore a filtering facepiece respirator, it no doubt was not provided to him by Jacobs Engineering Group, Inc. as part of a comprehensive respiratory protection program and thus likely only reduced his exposure by a factor of 5 to 10. This is explain why he stated that it was ineffective. Given the very high laborer exposures documented in the table above, this modest reduction in exposure, assuming he was provided a filtering facepiece respirator, would still have left him with exposures well above ambient levels.

In addition to the air sampling described above, we can look to indirect evidence for his exposures.

**Evidence of Mr. Church's Exposure:**

Mr. Church has described his exposure to coal ash while working at the Kingston site. For example, in responding to interrogatories, he explained that as a laborer he had to work in multiple areas throughout the Kingston site. He noted that although he was permitted to wear a mask as part of his work duties, it "did not help protect [him] from coal ash." He stated that he still "would always have [coal ash] on [his] face and around [his] mouth." Mr. Church further explained that he previously had worked "at X10 tearing down an old [coal] ash silo." Mr. Church recalled that at the X10 site, he "never actually smelled ash in the air or had problems with coal ash getting on [his] skin or clothes." He noted, however, that the Kingston site was "completely different" because there was much more coal ash in the environment that "coated everything."

Mr. Church recalled that he was regularly "covered in coal ash from head to toe" at the Kingston site. As he put it, "coal ash would be all over [his] face and hair, and there was nowhere

to wash [it] off." Despite having protective gear, "it never really helped." Mr. Church recalled that the workers were forced to take their breaks and eat their lunches in areas there were "full of ash." He explained that the coal ash would "end[] up in your food and drinking water," and he recalled being able to "taste coal ash."

When Mr. Church finished his shift at the Kingston site, he explained that "there was nowhere to shower off or change clothes." As a result, he stated that he "ended up tracking so much coal ash into [his] personal truck that it destroyed [his] seats and [his] floorboard." He recalled tracking the coal ash into his home, and he "could see it coming off oh [him] in the shower," which "stained and ruined the tile in [his] bathroom." As he described it, "You could see handprints on anything [he] touched." He recalled blowing his nose and "black muc[us] would come out several hours after" he had finished working and had left the Kingston site.

Based on the foregoing, it is my scientific opinion that Johnny Church, more likely than not, was exposed by inhalation and ingestion to a long-term, continuous, and high intensity dose of coal fly ash during his employment at the Kingston site sufficient to result in numerous negative health effects as supported by the scientific literature.

## ADDENDUM 10: Individualized Exposure Assessment of Ansol Clark

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by Ansol Clark at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; and Sanjay Rajagopalan, MD.

**Materials Reviewed:**

With regard to Mr. Clark, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff Ansol Clark's Responses to Interrogatories;
- Employment Records for Ansol Clark;
- Personal Air Monitoring Data;
- October 26, 2016 Affidavit of Ansol Clark;
- September 17, 2020 Deposition of Janie Clark; and
- April 17, 2017 Deposition of Ansol Clark.

**Ansol Clark's Work at the Kingston Coal Ash Recovery Site:**

Union records indicate that Mr. Clark was employed by GUBMK in December 2008 through March 2013. Mr. Clark estimates he worked on the Kingston site from December 2008, shortly after the coal ash spill occurred, to March 15, 2013. Mr. Clark worked inside the exclusion zone on the Kingston site as a "fuel man," fueling various vehicles and heavy equipment, which drove on and was used on and around the Kingston site. This job required him to work on the

Kingston site during that period. Mr. Clark estimates that he regularly worked up to seven days a week for approximately fifteen hours per day, due to overtime, during this period from December 2008 to March 15, 2013. Janie Clark, his spouse, described Mr. Clark's working hours as "very extreme."

**Sampling and Testing Relevant to Ansol Clark's Work:**

There are two separate SEGs for fuel truck drivers: Fuel Truck Driver in the Teamster group, and Fuel Truck Operator in the On-Land Operation group. The SEG of Fuel Truck Driver was not adequately monitored, with only a single air sample collected from 2009 to 2013, on August 1, 2012. It measured PPM only, with a time-weighted average concentration of 380 $\mu g/m^3$. Trial Exhibit 91 indicates that it was raining on August 1, 2012, which no doubt served to greatly reduce the airborne dust concentration. The measured airborne concentration was approximately thirty times higher than the likely ambient background $PM_{2.5}$ concentration, indicating a substantial exposure to airborne fly ash.

Ten samples were collected for the SEG Fuel Truck Operator, all in 2012. The analytical results for two samples were not included in the data base, and two samples were voided for sampling errors. Thus, only 6 valid sample results are included. The highest RPM concentration measured was 320 $\mu g/m^3$, also approximately thirty times higher than the ambient background concentration. The highest measured silica concentration was 24 $\mu g/m^3$, just slightly less than the ACGIH silica TLV® of 25 $\mu g/m^3$. The limited measurements collected for fuel truck drivers thus indicate a substantially elevated exposure for this group to RPM and silica.

In addition to the air sampling described above, we can look to indirect evidence for his exposures.

**Evidence of Ansol Clark's Exposure:**

Mr. Clark has described his exposure to coal ash while working at the Kingston site. For example, in responding to interrogatories, he explained that he "would be working in coal ash" for many hours each workday. As he explained, "[c]oal ash was everywhere" and was visible "like a blue haze hanging over the clean-up site." He noted that he was "constantly covered in coal ash" and that the coal ash was "on [his] face and in [his hair], and [] would end up . . . in [his] mouth, nose, eyes, and ears."

Mr. Clark recalled that a Jacobs Engineering Group, Inc. employee had told workers at the Kingston site that the coal ash was safe. As Mr. Clark testified in an affidavit, Tom Bock, a Jacobs Engineering Group, Inc. employee, "said that you could eat a pound of fly ash a day and it would not hurt you." Based upon this, Mr. Clark and other workers believed that the coal ash was safe to be around.

Mr. Clark recalled that when he left the Kingston site after working each day he "would be absolutely covered in coal dust." He explained that there was no way to "shower or get [the coal ash] off our bodies and work clothes" at the Kingston site. As he recalled, no running water or wipes were provided for him, or other workers, to clean coal ash off their bodies, clothing, or other belongings. As he noted, the "only thing" available to wash off coal ash was a "boot 'wash,'" which he described as "just a plastic pan of water with brush," which was simply "full of muddy coal ash."

Mr. Clark explained that when he returned home from the Kingston site after working, that his wife "could smell the coal ash on [him] and taste it whenever she kissed [him]." When he showered, he "could see the coal ash coming off" and that it left a "permanent black grime in our

shower," which left the shower stained. Further, he recalled that when he could blow his nose or cough, a "black mucus would come out."

Mr. Clark explained that he could "taste the coal ash" from his work at the Kingston site. He described it as a "strong metallic taste." As he testified in his deposition, he inhaled coal ash to the point of being able to taste it "more [times] than [he] could count," estimating that this occurred "about three times a week." Mr. Clark explained that he wore what personal protective equipment "Jacobs said [he] could wear" but that it "didn't help protect me from coal ash." As he described it, "[a]ll [he] had was boots, gloves, vest, goggles, and a hard hat." When Mr. Clark asked for a mask, he was told that "they were not allowed" to be worn. In fact, Mr. Clark recalled asking Tom Bock for a mask because he could taste coal ash in the air, to which Mr. Bock responded that he would "check into it." However, after that conversation, Mr. Clark did not hear back from Mr. Bock and was not given permission to wear a mask while working on the Kingston site.

On another occasion, Mr. Clark was present with Mike McCarthy, another worker on the Kingston site, for a conversation with Chris Eich, a Jacobs Engineering Group, Inc. employee at the Kingston site. Mr. Clark testified that Mike McCarthy asked if they could "have a water truck and some dust masks." Mr. Clark recalled that Mr. Eich responded, "Do not even ask for a dust mask. You will be hanging yourself with your own you know what." Mr. McCarthy recalled this conversation between Mr. Eich, Mr. Clark, and himself in his deposition, and confirmed that Mr. Eich threatened him for asking for a mask. In short, Mr. Clark was told on multiple occasions that he would not be permitted to wear a mask while working on the Kingston site.

Mr. Clark's spouse, Janie Clark testified in her deposition that she noticed coal ash on Mr. Clark's clothes when he returned home from working at the Kingston site. She testified that she

noticed a “silver gray metallic colored” substance that was “like mud” on his clothes that would dry out and became “this dirt . . . [that] was still thick and [] was all over” his clothes.

Based on the foregoing, it is my scientific opinion that Ansol Clark, more likely than not, was exposed by inhalation and ingestion to a long-term, continuous, and high intensity dose of coal fly ash during his employment at the Kingston site sufficient to result in numerous negative health effects as supported by the scientific literature.

## ADDENDUM 11: Individualized Exposure Assessment of Dan Cody

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by Dan Cody at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; and Sanjay Rajagopalan, MD.

**Materials Reviewed:**

With regard to Mr. Cody, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff Dan Cody's Responses to Interrogatories;
- Personal Air Monitoring Data;
- November 15, 2020 Declaration of Dan Cody; and
- October 9, 2017 Deposition of Dan Cody.

**Dan Cody's Work at the Kingston Coal Ash Recovery Site:**

Mr. Cody estimates that he worked on the Kingston site from October 2009 to February 2015. Mr. Cody worked as a truck driver, driving a water truck and an articulating dump truck on and around the Kingston site during that period. Mr. Cody estimates that he worked six to seven days a week for approximately ten to fourteen hours per day during this period from October 2009 to February 2015.

**Sampling and Testing Relevant to Dan Cody's Work:**

Based on his work history, sampling collected in the following SEGs is relevant to Mr. Cody: Articulated Dump Truck Operator, Water Truck Operator. The highest measured concentrations in each SEG are summarized in the table below.

| SEG and year | Total Dust (μg/m$^3$) | Resp. PM (μg/m$^3$) | Silica (μg/m$^3$) |
|---|---|---|---|
| Artic Dump Truck Operator | | | |
| 2009 | 390 | 260 | 13 |
| 2010 | 350 | <42 | <8 |
| 2011 | | 200 | 17 |
| 2012 | | 120 | 13 |
| 2013 | | 62 | |
| 2014 | 200 | | |
| Water Truck Operator | | | |
| 2009 | 170 | | |
| 2010 | 380 | 109 | |
| 2011 | | 320 | 24 |
| 2012 | | 150 | 10 |
| 2013 | | 280 | |
| 2014 | | 58 | |

These sample results indicate a repeated, substantial exposure to workers in Mr. Cody's SEGs. The highest measured RPM concentration, 320 μg/m$^3$, is approximately thirty times higher than the likely ambient background $PM_{2.5}$ concentration, indicating a substantial exposure to airborne fly ash. The highest measured exposure to silica, a human carcinogen, 24 μg/m$^3$, is just slightly below the ACGIH TLV® of 25 μg/m$^3$.

In addition to the air sampling described above, we can look to indirect evidence for his exposures.

**Evidence of Dan Cody's Exposure:**

Mr. Cody has described his exposure to coal ash while working at the Kingston site. For example, in a declaration, he stated that he "worked directly in the exclusion zone" at the Kingston site. He stated that he also "hauled dirt to cap the coal ash" in the "east part of the [Kingston] site."

Mr. Cody recalled that "the coal ash dust created a thick cloud over the site." He stated that this cloud was often so thick that "other workers and drivers could not see [his] truck." He recalled that "[t]he ash was so fine that it kicked up into the air very easily." During his deposition, Mr. Cody testified that he was "in and around the ash every day."

As a water truck driver, Mr. Cody stated that his job included "spray[ing] water on the coal ash dust to keep it from blowing up into the air and all over the [Kingston] site." However, he noted that "it was extremely difficult to do so and was practically impossible when there was wind on the site." As he put it, "[i]t was a losing battle because there was so much fine dust on the site." He recalled that, at one point, he was "order[ed] to stop driving [his] truck around in the dust cloud because [he] was creating more dust that [he] was knocking [] down with the water." Mr. Cody was told "to stop spraying water [on the coal ash] and to just let it go because it was so out of control." As a result, he recalled that the coal ash "dust cloud spread out over the site and even over the water."

As he drove his trucks on and around the Kingston site, Mr. Cody recalled that "[t]he coal ash dust got all over [his] trucks." He stated that even though he kept his windows up, "the ash still poured into the cab through the air conditioner and any cracks or openings in the machines." He recalled that the coal ash "piled up on the dashboard" and that it was "impossible" to keep the coal ash out of his truck.

In addition to collecting on and in his trucks, Mr. Cody stated that "[t]he coal ash dust collected all over [him] at the [Kingston] site." He recalled that the coal ash "got on [his] clothes and covered [his] exposed skin." He stated that "[i]t got in [his] ears, nose, and mouth," and that he "could taste it in [his] mouth." He described the coal ash dust as "gritty like sand in [his] teeth." Mr. Cody explained that coal ash would get into his nose so often that he "got nose bleeds after a

while" and that "by end of day, [his] nostrils were raw." He recalled having to constantly blow his nose while on the site and that when he blew his nose, "black mucus came out."

Mr. Cody explained that there was "no way of cleaning the coal ash off" his body effectively. During his deposition, he testified that workers could wash their hands, but the "water was out of the river," which contained coal ash. He also discussed boot washing stations, which he described as "the size of a cat litter box" and "ineffective." He recalled that even when he used the boot washes, "the ash still clung to the bottom of [his] boots." As a result, "[a]t the end of the day, [he] tracked that coal ash on [his] boots into [his] personal car and in [his] home."

Mr. Cody stated that he was "not allowed to wear a mask or a respirator" at the Kingston site. He was "told daily that [he] could not wear a mask and that [he] would be sent home if [he] tried to wear a mask." He recalled that Tom Bock, a Jacobs Engineering Group, Inc. employee, told him that he "could not wear a mask and anyone who work one would be sent home if they did." He further recalled that Mr. Bock told him that Mr. Cody "could eat a pound of coal ash a day and it would not hurt [him]. . . . [and] that it was not possible for [Mr. Cody] to breathe in an amount of coal ash that would hurt [him]." On another occasion, Mr. Cody witnessed a worker wearing a face mask while working and was "told [] to remove it immediately or go home."

Based on the foregoing, it is my scientific opinion that Dan Cody, more likely than not, was exposed by inhalation and ingestion to a long-term, continuous, and high intensity dose of coal fly ash during his employment at the Kingston site sufficient to result in numerous negative health effects as supported by the scientific literature.

**ADDENDUM 12: Individualized Exposure Assessment of Philip Crick**

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by Philip Crick at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; and Theron Blickenstaff, MD.

**Materials Reviewed:**

With regard to Mr. Crick, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff Philip Crick's Responses to Interrogatories;
- Employment Records for Philip Crick;
- Personal Air Monitoring Data; and
- August 11, 2020 Deposition of Philip Crick.

**Philip Crick's Work at the Kingston Coal Ash Recovery Site:**

Union records indicate that Philip Crick was employed by GUBMK from March 2011 through August 2014. Mr. Crick estimates he worked on the Kingston site from March 2011 to August 2014. Mr. Crick worked as a driver, driving an articulated dump truck, a fuel truck, and a bus on and around the Kingston site during that period. He also noted that he worked "directly in the ash spill cleanup," hauling ash, sludge slurry, and dirt around the site. Mr. Crick estimates that he regularly worked six days a week for approximately forty to sixty hours per week, due to overtime, during this period from March 2011 to August 2014.

**Sampling and Testing Relevant to Philip Crick's Work:**

Based on his work history, sampling collected in the following SEGs is relevant to Mr. Crick: Articulated Dump Truck Operator, Fuel Truck Operator. The highest measured concentrations in each SEG are summarized in the table below.

| SEG and year | Total Dust (μg/m$^3$) | Resp. PM (μg/m$^3$) | Silica (μg/m$^3$) |
|---|---|---|---|
| Artic Dump Truck Operator | | | |
| 2009 | 390 | 260 | 13 |
| 2010 | 350 | <42 | <8 |
| 2011 | | 200 | 17 |
| 2012 | | 120 | 13 |
| 2013 | | 62 | |
| 2014 | 200 | | |
| Fuel Truck Operator | | | |
| 2011 | | 320 | 24 |
| 2012 | | 150 | 10 |

These sample results indicate a repeated, substantial exposure to workers in Mr. Crick's SEGs. The highest measured RPM concentration, 320 μg/m$^3$, is approximately thirty times higher than the likely ambient background $PM_{2.5}$ concentration, indicating a substantial exposure to airborne fly ash. The highest measured exposure to silica, a human carcinogen, 24 μg/m$^3$, is just slightly less than the ACGIH TLV® of 25 μg/m$^3$. The fact that Mr. Crick worked significant overtime makes his substantial exposures even more serious; if, for example, he worked 80 hours per week rather than 40 it would have doubled his total dose from inhalation and ingestion and reduces the silica TLV® from 25 to 12.5 μg/m$^3$, and then 4 of the 6 silica measurements in the above table would have exceeded the TLV®.

In addition to the air sampling described above, we can look to indirect evidence for his exposures.

**Evidence of Philip Crick's Exposure:**

Mr. Crick has described his exposure to coal ash while working at the Kingston site. For example, in responding to interrogatories, he explained that he worked "directly on the ash spill cleanup." He recalled that "[t]he whole time while [he] worked at Kingston, [he] was always covered in coal ash." He described the coal ash as being "like talcum powder" because it was thin and would collect "all over [his] clothing, body, and personal belongings" and would get "in [his] hair, on [his] arms and hands, and in [his] ears." He recalled the coal ash "collect[ing] even worse on the bridge of [his] nose where [his] safety goggles were," and he noted that he later developed basal cell carcinoma in that location.

Mr. Crick recalled the coal ash collecting on the windshield of trucks, which would make it difficult to see. He explained that his truck was "almost always covered inside and out with coal ash." He stated, "Every evening, [he] wiped out the cab of the truck and the next morning when [he] got back to work, the ash already collected so much that [he] could write [his] name in it." He testified that even though he washed his truck every day after his shift, the coal ash would quickly cover it again in a thick layer.

Mr. Crick explained that when he left the Kingston site after working, "the ash from [his] clothes and boots would still get all in [his] car." He recalled that when he got home each day, he would remove his clothes and shower immediately. He stated that he "could see the black water come off [his] body in the shower."

During his deposition, Mr. Crick testified that the coal ash "would get in [his] nose and it would irritate [his] sinuses." Mr. Crick further testified that when he blew his nose "[he'd] have blood come out" and that his "throat would actually get sore sometimes and [he] could taste" the coal ash. Mr. Crick stated that he did not wear a mask while working at the Kingston site.

Based on the foregoing, it is my scientific opinion that Philip Crick, more likely than not, was exposed by inhalation and ingestion to a long-term, continuous, and high intensity dose of coal fly ash during his employment at the Kingston site sufficient to result in numerous negative health effects as supported by the scientific literature.

**ADDENDUM 13: Individualized Exposure Assessment of Joe Cunningham**

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by Joe Cunningham at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; and Theron Blickenstaff, MD.

**Materials Reviewed:**

With regard to Mr. Cunningham, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff Joe Cunningham's Responses to Interrogatories;
- Employment Records for Joe Cunningham;
- Personal Air Monitoring Data; and
- August 14, 2020 Deposition of Joe Cunningham

**Joe Cunningham's Work at the Kingston Coal Ash Recovery Site:**

Union records indicate that Mr. Cunningham was employed by Geo-Con from August 2, 2011 to April 2014. Mr. Cunningham estimates that he worked on the Kingston site from August 2011 to April 2014. Mr. Cunningham worked as a laborer, which required him to work on the Kingston site during that period. Mr. Cunningham estimates that he regularly worked up to seven days a week for approximately ten hours per day, or more due to overtime, during this period from August 2011 to April 2014.

**Sampling and Testing Relevant to Joe Cunningham's Work:**

Based on his work history, Mr. Cunningham worked in the General Laborer SEG. No personal air monitoring for Mr. Cunningham were found in the data base in this SEG, but he was included under the BP_General Laborer SEG, also included below. The highest measured concentrations in each year in this SEG are shown in the following table.

| SEG and year | Total Dust (µg/m$^3$) | Resp. PM (µg/m$^3$) | Silica (µg/m$^3$) |
|---|---|---|---|
| General Laborer | | | |
| 2009 | 2000 | 570 | 49 |
| 2010 | 2500 | 440 | <9 |
| 2011 | | 190 | 21 |
| 2012 | | 96 | |
| 2013 | | 120 | 16 |
| 2014 | 480 | | |
| BP_General Laborer | | | |
| 2011 | | 2200 | 32 |
| 2012 | | 810 | 67 |
| 2013 | | 890 | |

These sample results indicate a repeated, substantial exposure to workers in Mr. Cunningham's SEG. First consider the General Laborer SEG. The TPM measurements in 2009 and 2010 are among the highest measurement in the entire data set and represent levels that are very difficult to create and maintain in an outdoor environment, since they are approximately 100 times higher than the ambient background TPM levels. The highest measured RPM concentration, 570 µg/m$^3$, is approximately fifty times higher than the likely ambient background $PM_{2.5}$ concentration, indicating a substantial exposure to airborne fly ash. The highest measured exposure to silica, a human carcinogen, 49 µg/m$^3$, is twice the ACGIH TLV® of 25 µg/m$^3$.

For the BP_General Laborer SEG, the RPM and silica measurements here represent consistent exposures over several years that are among the highest in the entire data set. Workers in this SEG were regularly exposed to the highest levels of airborne contaminants seen on site.

The fact that Mr. Cunningham worked significant overtime makes his substantial exposures even more serious; if, for example, he worked 80 hours per week rather than 40 it would have doubled his total dose from inhalation and ingestion and reduces the silica TLV® from 25 to 12.5 $\mu g/m^3$, and then 5 of the 6 silica measurements in the above table would have exceeded the TLV®.

In addition to the air sampling described above, we can look to indirect evidence for his exposures.

**Evidence of Joe Cunningham's Exposure:**

Mr. Cunningham has described his exposure to coal ash while working at the Kingston site. For example, in responding to interrogatories, he explained that he "worked outside the entire time, . . . walk[ing] around all day in the ash." He explained that the coal ash would make "dust tornadoes." He further stated that while working the coal ash "would be all over [him]." He recalled that whenever he took his safety glasses off, "everything was black everywhere except for around [his] eyes where the glasses were," due to the coal ash.

During his deposition, Mr. Cunningham testified that the coal ash was inescapable. He explained that the coal ash "would get in [his] mouth" and "would get all over [him]. He stated that "[u]nless you had ear plugs in, it would get down in your ears." Mr. Cunningham further testified that even after leaving the Kingston site each day, he would blow his nose and "it would blow black."

Mr. Cunningham recalled one instance where he fell into a "soft spot," sinking "all the way up to [his] waist in ash." He explained that there was nowhere on the Kingston site for him to wash the coal ash off his body and his clothing. He noted that "[n]o one really washed [the coal ash] off because [the workers] were always so caked in ash anyway." Mr. Cunningham explained that "ash

would cover [his] clothing, including jeans, shirts, boots, . . . and company-issued gloves." However, he recalled that the coal ash would regularly get inside his gloves, which sometimes required him to take them off, at which point his "bare hands would be exposed to everything."

When he returned home each day from working at the Kingston site, Mr. Cunningham explained that he would take his clothes off outside the house. He stated that his wife had to wash his clothes "at least two times in an attempt to remove the coal ash." He explained that he would shower as soon as he returned home, but he noted, "It was difficult to scrub [the coal ash] off [his] body; especially on [his] elbows where [his] skin was showing through [his] clothes. It was also difficult to wash the ash off of [his] head and the back of [his] neck." He recalled that "the ash would get into [his] car," and he "had to vacuum it out quite often and at least twice per week" to ensure that his family was not exposed to the coal ash in their family vehicle.

During his deposition, Mr. Cunningham discussed sampling and testing performed at the Kingston site. He explained that workers were required to sign paperwork showing that samples had been collected; however, he explained that when he was required to sign this paperwork, no data was included. As he stated, he was never given testing results relating to the coal ash testing performed at the Kingston site. He testified that the workers were not told results: "Only thing we knew about our amounts was if – if they wanted us to know, they'd tell us. We never seen it. We never got handed a copy." As he explained, the workers were never given, shown, or told about testing results, but they were required to sign paperwork regarding the collection of samples and regarding testing.

Based on the foregoing, it is my scientific opinion that Joe Cunningham, more likely than not, was exposed by inhalation and ingestion to a long-term, continuous, and high intensity dose

of coal fly ash during his employment at the Kingston site sufficient to result in numerous negative health effects as supported by the scientific literature.

**ADDENDUM 14: Individualized Exposure Assessment of Enoch Roy Edmonds**

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by Enoch Roy Edmonds at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; and Sanjay Rajagopalan, MD.

**Materials Reviewed:**

With regard to Mr. Edmonds, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff Enoch Roy Edmonds' Responses to Interrogatories;
- Personal Air Monitoring Data; and
- August 23, 2017 Deposition of Enoch Roy Edmonds.

**Enoch Edmonds' Work at the Kingston Coal Ash Recovery Site:**

Mr. Edmonds estimates that he worked on the Kingston site from March 2009 to 2013. Mr. Edmonds worked as a truck driving, driving an articulated dump truck, a water truck, and a water van on and around the Kingston site during that period. Mr. Edmonds also hauled coal ash during that period. Mr. Edmonds estimates that he worked up to seven days a week for approximately twelve hours per day, or more due to overtime, during this period from March 2009 to 2013.

**Sampling and Testing Relevant to Enoch Edmonds' Work:**

Based on his work history, sampling collected in the following SEGs is relevant to Mr. Edmonds: Articulated Dump Truck Operator, Dump Truck Operator, Water Truck Operator. The highest measured concentrations in each SEG are summarized in the table below.

| SEG and year | Total Dust (µg/m$^3$) | Resp. PM (µg/m$^3$) | Silica (µg/m$^3$) |
|---|---|---|---|
| Artic Dump Truck Operator | | | |
| 2009 | 390 | 260 | 13 |
| 2010 | 350 | <42 | <8 |
| 2011 | | 200 | 17 |
| 2012 | | 120 | 13 |
| 2013 | | 62 | |
| 2014 | 200 | | |
| Dump Truck Operator | | | |
| 2009 | 360 | 260 | 13 |
| 2010 | | 95 | |
| 2011 | | 51 | |
| 2012 | | 36 | |
| Water Truck Operator | | | |
| 2009 | 170 | | |
| 2010 | 380 | 109 | |
| 2011 | | 320 | 24 |
| 2012 | | 150 | 10 |
| 2013 | | 280 | |
| 2014 | | 58 | |

These sample results indicate a repeated, substantial exposure to workers in Mr. Edmond's SEGs. The highest measured RPM concentration, 320 µg/m$^3$, is approximately thirty times higher than the likely ambient background $PM_{2.5}$ concentration, indicating a substantial exposure to airborne fly ash. The highest measured exposure to silica, a human carcinogen, 24 µg/m$^3$, is just slightly below the ACGIH TLV® of 25 µg/m$^3$. The fact that Mr. Edmonds worked significant overtime makes his substantial exposures even more serious; if, for example, he worked 80 hours per week rather than 40 it would have doubled his total dose from inhalation and ingestion and

reduces the silica TLV® from 25 to 12.5 $\mu g/m^3$, and then 5 of the 7 silica measurements in the above table would have exceeded the TLV®.

In addition to the air sampling described above, we can look to indirect evidence for his exposures.

**Evidence of Enoch Edmonds' Exposure:**

Mr. Edmonds has described his exposure to coal ash while working at the Kingston site. For example, in responding to interrogatories, he explained that he "worked all over the [Kingston] site and [he] was constantly covered in coal ash." As he put it, "[i]t did not matter if [he] was in one of the trailers or break areas; the entire place was coated [with coal ash]." He recalled that he regularly "could smell coal ash" and "could taste it" on several occasions. He also stated that "[t]he coal ash made [him] cough all the time" and whenever he "blew [his] nose or coughed, black coal ash would come out."

Mr. Edmonds recalled "countless times where [he] would eat [his] lunch and it would get covered in coal ash." Mr. Edmonds stated that coal ash regularly settled in the cab of his truck at the Kingston site, despite his best efforts to "keep coal ash out of [his] truck." He recalled that "Jacobs never did maintenance on the trucks or changed out the cabin air filters." He further recalled that there were boot washing stations on the Kingston site, but he stated that "they were completely useless" after only a few workers used them "because there was no way to change the water out. You would be washing your dirty boots in dirty water that was full of coal ash."

Mr. Edmonds explained that "everyone on site knew that you would get sent home for asking" for a mask to wear. Mr. Edmonds testified that John Cox, another worker on the Kingston site, "got run off because he asked for a respirator." Although he was not permitted to wear a mask, Mr. Edmonds did wear a personal air monitoring device. As he testified, he heard that "they would

knock the dirt out of" the personal air monitor before collecting samples for testing. Further, during his deposition, Mr. Edmonds questioned the reliability of the air monitoring data because "they took and wet everything down around where the monitors [were] to make sure they wouldn't get nothing."

Mr. Edmonds recalled that when he returned home each evening from working at the Kingston site, he "would have coal ash in [his] nose, ears, and mustache." He recalled that his wife would tell him that he was "completely covered in ash." He explained that his wife washed his work clothes separately and that she "had to clean [their] washing machine every single time she did a load of [his] laundry because so much ash would be left behind." Because of the coal ash on his clothes, he recalled that they had to get the washing machine "repaired several times."

Based on the foregoing, it is my scientific opinion that Enoch Edmonds, more likely than not, was exposed by inhalation and ingestion to a long-term, continuous, and high intensity dose of coal fly ash during his employment at the Kingston site sufficient to result in numerous negative health effects as supported by the scientific literature.

**ADDENDUM 15: Individualized Exposure Assessment of Paul Randy Farrow**

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by Paul Randy Farrow at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; and Theron Blickenstaff, MD.

**Materials Reviewed:**

With regard to Mr. Farrow, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff Paul Randy Farrow's Responses to Interrogatories;
- Personal Air Monitoring Data; and
- August 3, 2020 Deposition of Paul Randy Farrow.

**Paul Randy Farrow's Work at the Kingston Coal Ash Recovery Site:**

Mr. Farrow estimates he worked on the Kingston site from January 2009 through mid-March 2009. Mr. Farrow worked as a truck driver, driving an articulated dump truck and a water truck on and around the Kingston site during that period. Mr. Farrow estimates that he regularly worked seven days a week for approximately thirteen hours per day, due to overtime, during this period from January 2009 through mid-March 2009.

**Sampling and Testing Relevant to Paul Randy Farrow's Work:**

Based on his work history, sampling collected in the following SEGs is relevant to Mr. Farrow: Articulated Dump Truck Operator, Water Truck Operator. The highest measured concentrations in each SEG are summarized in the table below.

| SEG and year | Total Dust (µg/m$^3$) | Resp. PM (µg/m$^3$) | Silica (µg/m$^3$) |
|---|---|---|---|
| Artic Dump Truck Operator | | | |
| 2009 | 390 | 260 | 13 |
| 2010 | 350 | <42 | <8 |
| 2011 | | 200 | 17 |
| 2012 | | 120 | 13 |
| 2013 | | 62 | |
| 2014 | 200 | | |
| Water Truck Operator | | | |
| 2009 | 170 | | |
| 2010 | 380 | 109 | |
| 2011 | | 320 | 24 |
| 2012 | | 150 | 10 |
| 2013 | | 280 | |
| 2014 | | 58 | |

These sample results indicate a repeated, substantial exposure to workers in Mr. Farrow's SEGs. The highest measured RPM concentration, 320 µg/m$^3$, is approximately thirty times higher than the likely ambient background $PM_{2.5}$ concentration, indicating a substantial exposure to airborne fly ash. The highest measured exposure to silica, a human carcinogen, 24 µg/m$^3$, is just slightly less than the ACGIH TLV® of 25 µg/m$^3$. The fact that Mr. Farrow worked significant overtime makes his substantial exposures even more serious; if, for example, he worked 80 hours per week rather than 40 it would have doubled his total dose from inhalation and ingestion and reduces the silica TLV® from 25 to 12.5 µg/m$^3$, and then 4 of the 6 silica measurements in the above table would have exceeded the TLV®.

In addition to the air sampling described above, we can look to indirect evidence for his exposures.

**Evidence of Paul Randy Farrow's Exposure:**

Mr. Farrow has described his exposure to coal ash while working at the Kingston site. For example, in responding to interrogatories, he explained that he was "always covered in coal ash" when he was working at the Kingston site. He explained that "[a]nyone who walked onto the Kingston site ended up covered in coal ash."

Mr. Farrow recalled that he was so covered in coal ash, it "got into [his] car" and he "tracked it all to [his] home." He explained that when he showered after returning home each day after working at the Kingston site, he "could feel the fine and gritty ash on [him]." He noted that the coal ash "would get into [his] ears," which caused his "ear canals [to get] all black" from his working at the site.

Mr. Farrow testified during his deposition that he suffered from frequent nosebleeds during his time at the Kingston site, and "anytime [he] blew my nose, whether it was bleeding or not, [he] had black stuff in [his] nose." Mr. Farrow further testified that a supervisor told him that the coal ash was so safe, he "could bathe in it." Mr. Farrow stated that he did not wear a mask while working at the Kingston site.

Based on the foregoing, it is my scientific opinion that Paul Randy Farrow, more likely than not, was exposed by inhalation and ingestion to a long-term, continuous, and high intensity dose of coal fly ash during his employment at the Kingston site sufficient to result in numerous negative health effects as supported by the scientific literature.

**ADDENDUM 16: Individualized Exposure Assessment of Billy Joe Gibson**

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by Billy Joe Gibson at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; and Carrie A Redlich, MD, MPH.

**Materials Reviewed:**

With regard to Mr. Gibson, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff Billy Joe Gibson's Responses to Interrogatories;
- Employment Records for Billy Joe Gibson;
- Personal Air Monitoring Data;
- April 11, 2017 Deposition of Jeffrey Brewer;
- August 14, 2017 Deposition of Brian Thacker; and
- April 10, 2017 Deposition of Billy Joe Gibson.

**Billy Gibson's Work at the Kingston Coal Ash Recovery Site:**

Union records indicate that Mr. Gibson was employed by GUBMK from December 31, 2008 to November 13, 2014. Mr. Gibson estimates he worked on the Kingston site from January 2, 2009 to November 2014. Mr. Gibson worked as a heavy equipment operator, operating a front-end loader, and a track hoe on the Kingston site during that period. Mr. Gibson also operated a dredge and a water pump on the site. Mr. Gibson estimates he regularly worked up to seven days

a week for approximately twelve per day, or more due to overtime, at the beginning of this period, and worked full time throughout his tenure from December 2008 to November 2014.

**Sampling and Testing Relevant to Billy Gibson's Work:**

Based on his work history, air sampling done for the SEGs Excavator Operator, Dozer Operator and Dredge Boat Operator are relevant to Mr. Gibson's work at the Kinston site. The highest measured concentrations in each SEG are summarized in the table below.

| SEG and year | Total Dust (μg/m$^3$) | Resp. PM (μg/m$^3$) | Silica (μg/m$^3$) |
|---|---|---|---|
| Excavator Operator | | | |
| 2009 | 210 | 69 | |
| 2010 | 1400 | | |
| 2011 | | 690 | 18 |
| 2012 | | 520 | |
| 2013 | | 1100 | 7 |
| 2014 | 240 | | |
| Dozer Operator | | | |
| 2009 | 1300 | 210 | 18 |
| 2010 | 930 | 58 | |
| 2011 | | 200 | 26 |
| 2012 | | 77 | |
| 2013 | | 61 | |
| Dredge Boat Operator | | | |
| 2009 | | 100 | |
| 2010 | | <41 | |

These measurements indicate very high exposures to these SEGs. The TPM measurements represent very high exposures to total particle mass, and the RPM measurements for the Excavators in 2011-2013 are very high, approximately 50 – 100 times higher than the prevailing background $PM_{2.5}$ concentration, indicating a substantial exposure to airborne fly ash. The highest measured concentration for silica, a human carcinogen, exceeds the ACGIH TLV® of 25 μg/m$^3$. The fact that Mr. Gibson worked significant overtime makes his substantial exposures even more serious; if, for example, he worked 80 hours per week rather than 40 it would have doubled his total dose

from inhalation and ingestion and reduces the silica TLV® from 25 to 12.5 $\mu g/m^3$, and then 3 of the 4 silica measurements in the above table would have exceeded the TLV®.

In addition to the air sampling described above, we can look to indirect evidence for his exposures.

**Evidence of Billy Joe Gibson's Exposure:**

Mr. Gibson has described his exposure to coal ash while working at the Kingston site, For example, in responding to interrogatories, he described coal ash as fly ash. He explained that "[t]he site was always covered in fly ash." He stated, "The fly ash was so fine that it was difficult to control. Dry ash kicked up into the air so much that [he] could see it floating around in the air; the particles are small and shiny." Despite attempts to keep the ash from spreading, Mr. Gibson stated that "the ash was everywhere and covered everything."

Mr. Gibson described how the "dry and wet ash got all over [him], [his] clothes, and [his] boots." He explained that "[t]he ash also collected on any exposed skin including [his] face" and "was in [his] hair" and he "could also feel it in [his] nose, ears, eyes, and mouth." Mr. Gibson stated that he could "taste" the coal ash, and he described it as "gritty."

Mr. Gibson explained that some areas on the Kingston site were "really soft" because of the coal ash and that "[s]ometimes [workers] would fall through and down into the coal ash," sinking in coal ash past their waist. Mr. Gibson testified in his deposition that while operating a water pump, he was required to "wad[e] in ash almost knee deep."

Mr. Gibson explained that it was a struggle to keep coal ash out of the cab of his heavy equipment. He described how "[t]he ash would get into the closed cab through the window and vents because it was so thick in the air." He noted that the coal ash would collect in the cab and would form a "film" that covered the "floor, seats, dashboard, and windshield."

Mr. Gibson stated that the worker's lunches were eaten "right in the middle of where the coal ash was." He further explained that the workers did not have access to running water to clean the coal ash off their bodies, clothes, or other belongings. As he stated, "the only thing [workers] could use to get clean was wipes, but they never got all the coal ash off [his] body."

Mr. Gibson explained that he "carried [the coal ash] with [him] on [his] clothes everywhere when [he] left the site." He stated that "ash was all over [him] and it got in [his] personal car." He explained that when he returned home each day from working at the Kingston site, he had to take off his clothes outside, due to the coal ash on them. He noted that he "had to replace [his] washing machine" from washing his clothes, which were covered in coal ash. He further recalled that "if [he] needed to cough or blow [his] nose, the muc[us] would come out dark gray from all of the coal ash." Another worker, Jeffrey Brewer, testified during his deposition that Mr. Gibson had stopped "letting his wife wash his clothes because she was getting sick from [the coal ash] also."

Mr. Gibson recalled that the workers were not allowed to wear dust masks on the Kingston site. As he described it, the equipment the workers were provided did not "actually protect[ them] from the coal ash." He recalled that he asked Chris Eich, a Jacobs Engineering Group, Inc. employee "about wearing dust masks" on the site, and Mr. Eich responded that the workers "could not wear them" because the "public would see [them] wearing [the masks]." He further recalled Mr. Eich stating that workers would "be run off the site for wearing a dust mask." Mr. Gibson recalled seeing a worker wearing a mask "and someone made him take it off."

In his deposition, Mr. Gibson discussed going with another worker, Brian Thacker, for "an evaluation and test to see if they could wear a respirator . . . on the site." Mr. Thacker likewise testified that he and Mr. Gibson went for such an evaluation. However, Mr. Thacker explained that even after this evaluation, Tom Bock, a Jacobs Engineering Group, Inc. employee, denied him the

opportunity to wear a mask on the Kingston site. Mr. Gibson also testified that he heard Mr. Bock tell workers that they could "eat a pound of ash a day for the rest of [their] life before it would hurt [them]."

Based on the foregoing, it is my scientific opinion that Billy Joe Gibson, more likely than not, was exposed by inhalation and ingestion to a long-term, continuous, and high intensity dose of coal fly ash during his employment at the Kingston site sufficient to result in numerous negative health effects as supported by the scientific literature.

**ADDENDUM 17: Individualized Exposure Assessment of Timothy D. Gibson**

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by Timothy D. Gibson at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; and Carrie A. Redlich, MD, MPH.

**Materials Reviewed:**

With regard to Mr. Gibson, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff Timothy Gibson's Responses to Interrogatories;
- Employment Records for Timothy Gibson;
- Personal Air Monitoring Data;
- October 8, 2020 deposition of Rebecca Gibson; and
- August 28, 2017 Deposition of Timothy Gibson.

**Timothy Gibson's Work at the Kingston Coal Ash Recovery Site:**

Union records indicate that Timothy Gibson was employed by GUBMK from March 2011 to December 2011 and from March 2012 to August 2014. Mr. Gibson estimates he worked on the Kingston site from March 2011 to August 2014. Mr. Gibson worked as a truck driver, driving trucks on and around the Kingston site during that period. Mr. Gibson estimates that he regularly worked up to seven days a week for approximately ten hours per day, or more due to overtime, during this period from March 2011 to August 2014.

**Sampling and Testing Relevant to Timothy Gibson's Work:**

Mr. Gibson's work history indicates that he worked in the Dump Truck Operator SEG. The highest measured concentration in each year for this SEG are shown in the following table.

| SEG and year | Total Dust (μg/m$^3$) | Resp. PM (μg/m$^3$) | Silica (μg/m$^3$) |
|---|---|---|---|
| Dump Truck Operator | | | |
| 2009 | 360 | 260 | 13 |
| 2010 | | 95 | |
| 2011 | | 51 | |
| 2012 | | 36 | |

The sample results show that dump truck drivers such as Mr. Gibson were consistently exposed to airborne RPM concentrations that were elevated, with the highest value approximately 25 times higher than the prevailing background $PM_{2.5}$ concentration, indicating a substantial exposure to airborne fly ash. The fact that Mr. Gibson worked significant overtime makes his substantial exposures even more serious; if, for example, he worked 80 hours per week rather than 40 it would have doubled his total dose from inhalation and ingestion and reduced the silica TLV® from 25 to 12.5 μg/m$^3$, and then the silica measurement in the above table would have exceeded the TLV®.

In addition to the air sampling described above, we can look to indirect evidence for his exposures.

**Evidence of Timothy Gibson's Exposure:**

Mr. Gibson has described his exposure to coal ash while working at the Kingston site. For example, in responding to interrogatories, Mr. Gibson stated that he was "all over" the Kingston site and was "always covered in coal ash dust." He explained how he could "look out in the distance and [] could see the coal ash hanging in the air." He stated that even though water trucks attempted to wet the coal ash, "it'd be dry and dusty again in no time" and the coal ash would

spread around the site. He also recalled that the workers' "break areas were coated in coal ash because [they] were covered from head to toe]" in ash. As he put it, "You'd end up eating and drinking the coal ash." He described the coal ash as having a "weird taste . . . [that] just lingered in [his] mouth all day."

Mr. Gibson explained that he "was always breathing in dust when [he] was out at Kingston." He recalled that whenever he would blow his nose, "it'd come out black hours after [he] left the job site." He explained that he has never been a smoker but that he has "coughed like crazy when [he] started working there." Mr. Gibson stated that he "wanted to use a mask" on the site, but that the workers "weren't allowed to have them." In fact, Mr. Gibson testified during his deposition that he asked "Where's our dust masks" and he was told that if he "ask[ed] that question again [he] won't have a job." As he put it, all the workers "knew that [they] would be fired if [they] asked for a mask."

As Mr. Gibson put it, "[y]ou could never get clean from the ash" while at the Kingston site. He recalled that "[t]here wasn't any running water and the boot washes they provided made your boots even dirtier with coal ash because the water was never changed out." He recalled the coal ash getting in his hair and ears. He explained that he "would track the coal ash into [his] personal vehicle and home after every shift" at the Kingston site. Mr. Gibson noted that his washing machine had to be replaced three different times because, as his wife believed, "so much ashy mud built up in it after every load of laundry." In her deposition, Mr. Gibson's wife, Rebecca Gibson, confirmed her suspicion that the coal ash ruined their washing machine. She explained that Mr. Gibson regularly came home dirty, and his clothes were covered with coal ash, following his work at the Kingston site.

Based on the foregoing, it is my scientific opinion that Timothy Gibson, more likely than not, was exposed by inhalation and ingestion to a long-term, continuous, and high intensity dose of coal fly ash during his employment at the Kingston site sufficient to result in numerous negative health effects as supported by the scientific literature.

**ADDENDUM 18: Individualized Exposure Assessment of William Hedgecoth**

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by William Hedgecoth at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; and Theron Blickenstaff, MD.

**Materials Reviewed:**

With regard to Mr. Hedgecoth, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff William Hedgecoth's Responses to Interrogatories;
- Employment Records for William Hedgecoth;
- Personal Air Monitoring Data; and
- August 4, 2020 Deposition of William Hedgecoth.

**William Hedgecoth's Work at the Kingston Coal Ash Recovery Site:**

Union records indicate that Mr. Hedgecoth was employed by GUBMK from December 22, 2008 to November 16, 2011. Mr. Hedgecoth estimates he worked on the Kingston site from December 2008 to November 2011. Mr. Hedgecoth worked as a "flagger," directing trucks and heavy equipment throughout the Kingston site. Mr. Hedgecoth also cleaned heavy equipment, which required him to work on the Kingston site during that period. Mr. Hedgecoth estimates that he regularly worked up to seven days a week for approximately twelve hours per day for the first

five months of that period. Mr. Hedgecoth worked full time throughout his tenure at the Kingston site.

**Sampling and Testing Relevant to William Hedgecoth's Work:**

Mr. Hedgecoth's work history indicates that he worked in the Flagger SEG. The highest measured concentration in each year for this SEG are shown in the following table.

| SEG and year | Total Dust (μg/m$^3$) | Resp. PM (μg/m$^3$) | Silica (μg/m$^3$) |
|---|---|---|---|
| Flagger | | | |
| 2009 | 490 | 140 | 19 |
| 2010 | 530 | 110 | |
| 2011 | | 300 | 23 |
| 2012 | | 56 | 9 |

These sample results indicate a repeated, substantial exposure to workers in Mr. Hedgecoth's SEG. The highest measured RPM concentration, 300 μg/m$^3$, is approximately thirty times higher than the likely ambient background $PM_{2.5}$ concentration, indicating a substantial exposure to airborne fly ash. The highest measured exposure to silica, a human carcinogen, 23 μg/m$^3$, is just slightly lower than the ACGIH TLV® of 25 μg/m$^3$, and another silica measurement approached the TLV®. The fact that Mr. Hedgecoth worked significant overtime makes his substantial exposures even more serious; if, for example, he worked 80 hours per week rather than 40 it would have doubled his total dose from inhalation and ingestion and reduces the silica TLV® from 25 to 12.5 μg/m$^3$, and then 2 of the 3 silica measurements in the above table would have exceeded the TLV®.

In addition to the air sampling described above, we can look to indirect evidence for his exposures.

**Evidence of William Hedgecoth's Exposure:**

Mr. Hedgecoth has described his exposure to coal ash while working at the Kingston site. For example, in responding to interrogatories, he explained that he "stood and walked around in the [coal] ash for all of [his] jobs." He stated that he "walked around on the wet ash all day and it covered [his] boots" and that "[t]he dry ash that was always floating in the air got all over [his] body." Mr. Hedgecoth recalled that if he "just barely brushed [his] arm, ash dust would fly off [him]." He explained that the coal ash "got in [his] hair, nose, ears, and [] all over [his] exposed skin."

Mr. Hedgecoth recalled one occasion where he "fell in a soft spot [of coal ash] up to [his] hips" and was stuck there for approximately twenty minutes. He explained that it was raining, and "the suction immobilized [him]" in the wet coal ash, which was "like mud, but worse."

Mr. Hedgecoth explained that when he worked as a flagger, "even more ash would get on [him] from all the dust that the trucks would kick up as they drove by [him]." He stated that he "blew [his] nose all the time and the dust would come out," noting that he wore a bandana "just so [he] could wipe the ash from [his] nose more easily." He further explained that he "constantly had to wipe [coal ash] out of [his] eyes and ears," even though he was wearing safety glasses and ear plugs. He recalled the coal ash getting in his mouth "so bad that it was even in [his] spit." Mr. Hedgecoth explained that he regularly drank water, but that "[a]sh dust was always inside the cup." He stated that he "drank it anyway because [he] was so thirsty and have no reason to think it would hurt [him]."

Mr. Hedgecoth testified in his deposition that the coal ash was "so horrible" because "it was everywhere." He recalled that he was "blowing [coal ash] out of [his] nose . . . [and] was spitting it out of [his] mouth" on a daily basis. Mr. Hedgecoth testified that he requested to wear a

mask while working at the Kingston site, but his supervisor, Mike Robinette, denied his request. Regarding his request, he explained that Mr. Robinette "said no, they won't let him. [Jacobs] wouldn't allow it." Mr. Hedgecoth testified that no workers at the Kingston site were permitted to wear masks while working, except for certain workers who were "deconning." Mr. Hedgecoth also testified that Tom Bock, a Jacobs Engineering Group, Inc. employee, told the workers at the site that coal ash was safe, saying "[A]ll it is is dust. You'd don't have to worry about it. It's like mud." Mr. Hedgecoth stated that the workers believed Mr. Bock and assumed the coal ash was safe.

Based on the foregoing, it is my scientific opinion that William Hedgecoth, more likely than not, was exposed by inhalation and ingestion to a long-term, continuous, and high intensity dose of coal fly ash during his employment at the Kingston site sufficient to result in numerous negative health effects as supported by the scientific literature.

## ADDENDUM 19: Individualized Exposure Assessment of Stanley Hill

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by Stanley Hill at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; and Carrie A Redlich, MD, MPH.

**Materials Reviewed:**

With regard to Mr. Hill, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff Stanley Hill's Responses to Interrogatories;
- Employment Records for Stanley Hill;
- Personal Air Monitoring Data;
- April 7, 2017 Deposition of Stanley Hill; and
- November 5, 2020 Deposition of Stanley Hill.

**Stanley Hill's Work at the Kingston Coal Ash Recovery Site:**

Union records indicate that Stan Hill was employed by GUBMK in December 2008 to January 2012 and from April 2012 to October 2012. Mr. Hill estimates he worked on the Kingston site from December 2008 to December 2011, in January 2012, and from April 2012 to October 2012. Mr. Hill worked as the head general foreman, which required him to work on the Kingston site during that period. Mr. Hill estimates that he regularly worked up to six days a week for

approximately eleven hours per day, or more due to overtime, during this period from December 2008 to October 2012.

**Sampling and Testing Relevant to Stanley Hill's Work:**

Mr. Hill's SEG was Management/Administration. Unfortunately, only six workers in this SEG were monitored over the entire monitoring period. However, due to evidence described below, i.e., Mr. Hill spent considerable time walking throughout the exclusion zone, the other site-wide support staff SEGs, i.e., Field Staff and Sample Technician, likely are relevant to her exposures. The highest measured concentrations in each of these SEGs are summarized in the table below.

| SEG and year | Total Dust (μg/m$^3$) | Resp. PM (μg/m$^3$) | Silica (μg/m$^3$) |
|---|---|---|---|
| Field Staff | | | |
| 2010 | | <44 | |
| 2011 | | 220 | 14 |
| 2012 | | 27 | |
| 2013 | | 77 | |
| 2014 | 180 | 47 | |
| Management/Admin | | | |
| 2009 | 290 | 67 | |
| Sample Technician | | | |
| 2010 | <190 | <134 | |
| 2011 | | 560 | 19 |
| 2012 | | 920 | 23 |

These sample results, in particular those for sample technicians, whose job it was to travel around the entire site monitoring workers and collect samples, confirm the likelihood that Mr. Hill was exposed to substantially elevated levels of airborne fly ash and its toxic constituents when he was required to leave his office. The sample technician RPM concentration of 920 μg/m$^3$ is almost 100 times higher than the prevailing background $PM_{2.5}$ concentration, indicating a substantial exposure to airborne fly ash. The highest measured concentration for silica, a human carcinogen, is just lower than the ACGIH TLV® of 25 μg/m$^3$. The fact that Mr. Hill worked significant overtime

makes his substantial exposures even more serious; if, for example, he worked 80 hours per week rather than 40 it would have doubled his total dose from inhalation and ingestion and reduces the silica TLV® from 25 to 12.5 $\mu g/m^3$, and then all 3 of the silica measurements in the above table would have exceeded the TLV®.

In addition to the air sampling described above, we can look to indirect evidence for his exposures.

**Evidence of Stanley Hill's Exposure:**

Mr. Hill has described his exposure to coal ash while working at the Kingston site. For example, in responding to interrogatories, he explained that his job as head general foreman required him to walk around the Kingston site and "the ash was always all over [him]" as a result. According to Mr. Hill, the coal ash "got in [his] hair, nose, ears, mouth, eyes, and underneath [his] fingernails." He recalled that the coal ash so regularly settled in his hair that his scalp turned dark. He explained that he could see the coal ash in the air constantly, and he could smell and taste it. He further stated that he "would get nose bleeds 2 or 3 times a week" because of the coal ash.

Mr. Hill parked his personal vehicle outside the work zone, but that vehicle still had a grey film of coal ash which destroyed the windshield wipers to the point that they had to be replaced "at least 12 times in a couple of years." He explained that the coal ash also got inside his personal vehicle and covered the floor mats, dashboard, steering wheel and windows. He stated that the coal ash inside his vehicle "was so bad it made it hard to see the gauges."

Mr. Hill had an office in the Berkshire house, which was located on the Kingston site. He recalled that the "office was always covered in ash." He further recalled "see[ing] ash in [his] coffee cup" and stated that "ash even got under the lids of the water bottles [workers] drank from." He explained that when he drank from the bottle, "[he] could taste [the coal ash]" which was

"gritty" in his teeth. According to Mr. Hill, the coal ash on the floor of the workers' break room was "at least 2 to 3 inches deep."

When Mr. Hill returned home each day from working at the Kingston site, he would "pull[ his] clothes off on [the] porch and went straight to shower." He recalled that the water in the shower turned black from all the coal ash on his skin. He stated that, "[e]ven though [he] tried to wipe all the ash out of [his] eyes, [he] would wake up in the middle of the night and still feel it in [his] eyes."

During his deposition, Mr. Hill testified that he often had to go into the coal ash with waders on and "there was such dust that you couldn't see up the valley to the east or the north." Regardless of his being surrounded by coal ash on the Kingston site, he testified that the workers "were never allowed to have dust masks." In fact, Mr. Hill testified that, because he was a foreman on the site, other workers would ask him for a respirator or dust mask. He explained that he would then "ask management and management would tell [him] that [masks are] not to be worn on the [Kingston] site."

Based on the foregoing, it is my scientific opinion that Stanley Hill, more likely than not, was exposed by inhalation and ingestion to a long-term, continuous, and high intensity dose of coal fly ash during his employment at the Kingston site sufficient to result in numerous negative health effects as supported by the scientific literature.

**ADDENDUM 20: Individualized Exposure Assessment of David Johnson**

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by David Johnson at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; and Theron Blickenstaff, MD.

**Documents Reviewed:**

With regard to Mr. Johnson, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff David Johnson's Responses to Interrogatories;
- Employment Records for David Johnson;
- Personal Air Monitoring Data; and
- August 4, 2020 Deposition of David Johnson.

**David Johnson's Work at the Kingston Coal Ash Recovery Site:**

Union records indicate that David Johnson was employed by GUBMK from April 2011 to December 2013. Mr. Johnson estimates that he worked on the Kingston site from April 2011 to December 2013. Mr. Johnson worked as a truck driver, driving an articulated dump truck on and around the Kingston site during that period. Mr. Johnson estimates that he regularly worked fix or six days a week for approximately ten hours per day, or more due to overtime, during this period from April 2011 to December 2013.

**Sampling and Testing Relevant to David Johnson's Work:**

His work history indicates that Mr. Johnson worked in the Articulated Dump Truck Operator SEG. The highest measured concentrations in this SEG are summarized in the table below.

| SEG and year | Total Dust (μg/m$^3$) | Resp. PM (μg/m$^3$) | Silica (μg/m$^3$) |
|---|---|---|---|
| Artic Dump Truck Operator | | | |
| 2009 | 390 | 260 | 13 |
| 2010 | 350 | <42 | <8 |
| 2011 | | 200 | 17 |
| 2012 | | 120 | 13 |
| 2013 | | 62 | |
| 2014 | 200 | | |

These sample results indicate a repeated, substantial exposure to workers in Mr. Johnson's SEG. The highest measured RPM concentration, 260 μg/m$^3$, is approximately 25 times higher than the likely ambient background $PM_{2.5}$ concentration, indicating a substantial exposure to airborne fly ash. The highest measured exposure to silica, a human carcinogen, 17 μg/m$^3$, is slightly less than the ACGIH TLV® of 25 μg/m$^3$. The fact that Mr. Johnson worked significant overtime makes his substantial exposures even more serious; if,for example, he worked 80 hours per week rather than 40 it would have doubled his total dose from inhalation and ingestion and reduces the silica TLV® from 25 to 12.5 μg/m$^3$, and then 3 of the 64silica measurements in the above table would have exceeded the TLV®.

In addition to the air sampling described above, we can look to indirect evidence for his exposures.

**Evidence of David Johnson's Exposure:**

Mr. Johnson has described his exposure to coal ash while working at the Kingston site. For example, in responding to interrogatories, he explained that "[w]hile working at the Kingston site,

[he] was always covered in coal ash." He noted that the coal ash regularly got in his truck's air filter, which "would be covered with coal ash" so thick that he "could beat the dust off of it." He recalled that his "bright yellow truck" became so covered in coal ash that it "look[ed] grey." He also recalled the coal ash "get[ting] on [his] food" while easting at the Kingston site.

Mr. Johnson explained that his clothes regularly were covered in coal ash, so much so that he "had to wash the clothes that [he] wore to work at the site every day." He recalled that there was a "small pan of water to wash [his] boots off when leaving the site." He also testified during his deposition that he had to use "bottled water" and "paper towels" to wash coal ash off himself.

Mr. Johnson discussed how he regularly tried to clean the coal ash out of his truck while working on the Kingston site. He recalled coal ash also getting in his personal car, which he had to clean out roughly every couple of days. When he returned home each day after working at the site, he would take his clothes off before entering the house. He recalled that he "couldn't get [the coal ash] off of [himself]" or his clothes. His girlfriend would wash his work clothes in the washing machine, and Mr. Johnson recalled that "she had to wipe the washer out to get the black [from the coal ash] out of it." He further explained that when he would shower "the water would turn black" due to the coal ash.

In his deposition, Mr. Johnson recalled receiving "training" when he first arrived at the Kingston site to work. He "remember[ed] very clearly" that during this training, Tom Bock, a Jacobs Engineering Group, Inc. employee, "told [the workers they] could eat a pound of [coal ash] a day" and that the coal ash "wouldn't hurt" them. Although he did not "eat a pound" of coal ash, Mr. Johnson believed that, over the course of his working at the Kingston site, he "might have ingested a pound of it."

Mr. Johnson testified that he did not wear a mask or respirator while working at the Kingston site. He explained that "[t]hey didn't want [the workers] to wear them." He recalled another worker, Kevin Thompson, asking to wear a mask, but "they finally got rid of him because he was told to wear a mask." Mr. Johnson stated that Mr. Thompson "left Kingston . . . because they wouldn't let him work . . . and wear a mask." Prior to this, Mr. Johnson never felt the need to wear a mask because Mr. Bock had told him and the other workers that "there wasn't nothing to hurt you" in the coal ash.

Based on the foregoing, it is my scientific opinion that David Johnson, more likely than not, was exposed by inhalation and ingestion to a long-term, continuous, and high intensity dose of coal fly ash during his employment at the Kingston site sufficient to result in numerous negative health effects as supported by the scientific literature.

## ADDENDUM 21: Individualized Exposure Assessment of Fred C. Jones

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by Fred C. Jones at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; and Theron Blickenstaff, MD.

**Materials Reviewed:**

With regard to Mr. Jones, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff Fred C. Jones' Responses to Interrogatories;
- Employment Records for Fred C. Jones;
- Personal Air Monitoring Data; and
- August 31, 2020 Deposition of Fred C. Jones.

**Fred C. Jones' Work at the Kingston Coal Ash Recovery Site:**

Union records indicate that Mr. Jones was employed by GUBMK from November 2009 to May 2011; and by Johnson Contractors Inc. from August 2011 to February 2012. Mr. Jones estimates that he worked on the Kingston site from October 2009 to February 2012. Mr. Jones worked in the exclusion zone on the Kingston site as a truck driver, driving a "guzzler truck" on and around the Kingston site. Mr. Jones estimates that he worked up to seven days a week for approximately ten hours per day, or more due to overtime, during this period from October 2009 to February 2012.

**Sampling and Testing Relevant to Fred C. Jones' Work:**

Mr. Jones' work history indicates that he worked in the Dump Truck Operator SEG. The highest measured concentration in each year for this SEG are shown in the following table.

| SEG and year | Total Dust (μg/m$^3$) | Resp. PM (μg/m$^3$) | Silica (μg/m$^3$) |
|---|---|---|---|
| Dump Truck Operator | | | |
| 2009 | 360 | 260 | 13 |
| 2010 | | 95 | |
| 2011 | | 51 | |
| 2012 | | 36 | |

The sample results show that dump truck drivers such as Mr. Jones were consistently exposed to airborne RPM concentrations that were elevated, with the highest value about 25 times higher than the prevailing background $PM_{2.5}$ concentration, indicating a substantial exposure to airborne fly ash. The fact that Mr. Jones worked significant overtime makes his substantial exposures even more serious; if, for example, he worked 80 hours per week rather than 40 it would have doubled his total dose from inhalation and ingestion and reduced the silica TLV® from 25 to 12.5 μg/m$^3$, and then the silica measurement in the above table would have exceeded the TLV®.

In addition to the air sampling described above, we can look to indirect evidence for his exposures.

**Evidence of Fred C. Jones' Exposure:**

Mr. Jones has described his exposure to coal ash while working at the Kingston site. For example, in responding to interrogatories, he explained that coal ash "was always flying around in the air on the [Kingston site]." He explained that "[t]he coal ash stuck to [him]" and was "all over [him] including [his] hair, nose, mouth, ears, and all on [his] skin." He recalled the ash covering his hands and arms regularly and getting in his hair "even though [he] worse a hardhat." He stated that he "could see the ash particles all over [his] clothes."

Despite being covered in ash, there was not a place on the Kingston site for Mr. Jones to clean the ash off his body or clothes. He stated that he "had to pour water from a water bottle on [his] arms to try to rinse off the ash." When he washed his face, his skin felt "gritty." He also explained that he was "constantly wip[ing] down [his safety glasses with a handkerchief" in order to see through the coal ash. He stated that he "had to blow and wipe [his] nose constantly with a handkerchief . . . so much that it turned black" from the ash in his mucus.

Mr. Jones recalled the coal ash "cover[ing] the outside of [his] truck," and he explained that the coal ash "got all in [his] cab." He explained that coal ash was present in the trailer where workers would eat their lunch. As he stated, although the trailer was "swept out several times a day," the coal ash returned and "just [got] on everything . . . [and] just constantly [was] getting on the floors and on the tables." He recalled that as trucks drove on and around the Kingston site, "the ash [would] kick up and cover [him]."

Mr. Jones explained that he "had to wipe [him]self down before [he] got into [his] personal truck at the end of the day" following work at the Kingston site. He "always tried to knock as much of the coal ash off of [himself] before [he] went home, but [he] could not get all of the ash off of [himself] or [his] clothes." When he got home each day from working at the site, he took his clothes off in the basement to avoid tracking more coal ash into his home.

During his deposition, Mr. Jones described the dust at the Kingston site as "constant" and "overwhelming" because there was "so much of it." Mr. Jones did not wear a mask or respirator during the time he worked at the Kingston site. He testified that Jacobs employees told him that dust masks and respirators were not required at the site because the coal ash was "safe" and "[t]hey said you could eat it." Mr. Jones explained that it was common knowledge to not request or discuss the need for a mask or "you may be getting your layoff." As he explained, he "had no reason at

the time to suspect that all that ash on [his] body and personal belonging[s] would hurt [him]," because the workers had been told the coal ash was safe.

Based on the foregoing, it is my scientific opinion that Fred C. Jones, more likely than not, was exposed by inhalation and ingestion to a long-term, continuous, and high intensity dose of coal fly ash during his employment at the Kingston site sufficient to result in numerous negative health effects as supported by the scientific literature.

**ADDENDUM 22: Individualized Exposure Assessment of David Jones**

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by David Jones at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; and Theron Blickenstaff, MD.

**Materials Reviewed:**

With regard to Mr. Jones, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff David Jones' Responses to Interrogatories;
- Personal Air Monitoring Data;
- October 23, 2020 Deposition of David Jones; and
- November 2, 2020 Deposition of David Jones.

**David Jones' Work at the Kingston Coal Ash Recovery Site:**

Mr. Jones estimates that he worked on the Kingston site from August 21, 2009 to June 28, 2012, and from August 1, 2012 to August 9, 2013. Mr. Jones worked as a "flagger," directing trucks and heavy equipment on and throughout the Kingston site. Mr. Jones also worked "in the ball field delivering [coal] ash from the slew trench to rail cars." Mr. Jones also sometimes operated a vacuum truck on the Kingston site. These jobs required him to work on the Kingston site during those periods. Mr. Jones estimates that he initially worked up to seven days per week for

approximately twelve hours per day, but then estimates that after a few months he regularly worked six to seven days per week for approximately ten hours per day during those periods.

**Sampling and Testing Relevant to David Jones' Work:**

Mr. Jones' work history indicates that he worked in the following SEGs: Flagger and Vacuum Truck Operator. The highest measured concentration in each year for this SEG are shown in the following table.

| SEG and year | Total Dust (µg/m$^3$) | Resp. PM (µg/m$^3$) | Silica (µg/m$^3$) |
|---|---|---|---|
| Vacuum Truck Operator | | | |
| 2009 | | 110 | 30 |
| 2012 | | 52 | |
| Flagger | | | |
| 2009 | 490 | 140 | 19 |
| 2010 | 530 | 110 | |
| 2011 | | 300 | 23 |
| 2012 | | 56 | 9 |

These sample results indicate a repeated, substantial exposure to workers in Mr. Jones' SEGs. The highest measured RPM concentration, 300 µg/m$^3$, is approximately thirty times higher than the likely ambient background $PM_{2.5}$ concentration, indicating a substantial exposure to airborne fly ash. The highest measured exposure to silica, a human carcinogen, 30 µg/m$^3$, exceeds the ACGIH TLV® of 25 µg/m$^3$, and two other silica measurements approach the TLV®. The fact that Mr. Jones worked significant overtime makes his substantial exposures even more serious; if, for example, he worked 80 hours per week rather than 40 it would have doubled his total dose from inhalation and ingestion and reduces the silica TLV® from 25 to 12.5 µg/m$^3$, and then 3 of the 4 silica measurements in the above table would have exceeded the TLV®.

In addition to the air sampling described above, we can look to indirect evidence for his exposures.

**Evidence of David Jones' Exposure:**

Mr. Jones has described his exposure to coal ash while working at the Kingston site. For example, in responding to interrogatories, he explained that he "worked directly in the coal ash and regularly walked throughout the site." In his depositions, he testified that he was in the exclusion zone, or the "ash zone" as he called it, on the Kingston site nearly all the time.

Mr. Jones explained that his job duties on the Kingston site required to be in close proximity to the ash. He explained that as a flagger, he was required to stand outdoors on the Kingston site, directing trucks and heavy equipment throughout the site. He stated that the trucks and heavy equipment regularly kicked up coal ash as they drove by, which regularly settled on and covered him. He recalled that the coal ash "got all over [him] and [his] personal belongings," including "in [his] hair and on [his] skin." He further explained that he "worked in the ball field delivering ash from the slew trench to rail cars." He recalled that the coal ash "got all over [his] truck."

During his depositions, Mr. Jones stated that he worked in the "exclusion zone" for nearly all the time he worked at the site. He testified that when he would eat lunch, even if in a designated area, the designated areas were regularly covered with coal ash, and he recalled tasting coal ash on his food. He further explained that his truck on the Kingston site was regularly covered with coal ash.

Mr. Jones further testified that Tom Bock, a Jacobs Engineering Group, Inc. employee, told the workers that masks or respirators were not allowed to be worn while working on the Kingston site. He also recalled Mr. Bock saying that "you could take a spoon and eat the fly ash and you'd be okay." Mr. Jones also testified that he complained to Chris Eich, another Jacobs Engineering Group, Inc. employee, that the workers should be allowed to wear respirators and

Tyvek suits while working on the site. He recalled that Mr. Eich responded that "This is the government . . . The government will knowingly put [the workers] in harm's way." Mr. Jones believed that he was laid off because he complained to Tom Bock that he was having problems breathing. As he recalled, he was laid off approximately two or three weeks after having such a discussion with Tom Bock.

Based on the foregoing, it is my scientific opinion that David Jones, more likely than not, was exposed by inhalation and ingestion to a long-term, continuous, and high intensity dose of coal fly ash during his employment at the Kingston site sufficient to result in numerous negative health effects as supported by the scientific literature.

**ADDENDUM 23: Individualized Exposure Assessment of Jimmy Kilby**

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by Jimmy Kilby at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; and Sanjay Rajagopalan, MD.

**Materials Reviewed:**

With regard to Mr. Kilby, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff Jim Kilby's Responses to Interrogatories;
- Personal Air Monitoring Data; and
- October 12, 2017 Deposition of Jimmy Kilby.

**Jimmy Kilby's Work at the Kingston Coal Ash Recovery Site:**

Mr. Kilby estimated that he worked on the Kingston site from December 2008 to August 2015. Mr. Kilby was among the first workers on the Kingston site following the coal ash spill. Mr. Kilby worked as a heavy equipment operator, operating a variety of machines, including a track hoe and a bulldozer, on and around the Kingston site. Mr. Kilby estimates that he worked up to seven days a week for approximately twelve per day, or more due to overtime, during this period from December 2008 to August 2015. During a seven month period, Mr. Kilby recalled working "without a day off."

**Sampling and Testing Relevant to Jimmy Kilby's Work:**

Based on his work history, air sampling done for the SEGs Excavator Operator and Dozer Operator are relevant to Mr. Kilby's work at the Kinston site. The highest measured concentrations in each SEG are summarized in the table below.

| SEG and year | Total Dust (µg/m$^3$) | Resp. PM (µg/m$^3$) | Silica (µg/m$^3$) |
|---|---|---|---|
| Excavator Operator | | | |
| 2009 | 210 | 69 | |
| 2010 | 1400 | | |
| 2011 | | 690 | 18 |
| 2012 | | 520 | |
| 2013 | | 1100 | 7 |
| 2014 | 240 | | |
| Dozer Operator | | | |
| 2009 | 1300 | 210 | 18 |
| 2010 | 930 | 58 | |
| 2011 | | 200 | 26 |
| 2012 | | 77 | |
| 2013 | | 61 | |

These measurements indicate very high exposures to these SEGs. The TPM measurements represent very high exposures to total particle mass, and the RPM measurements for the Excavators in 2011-2013 are very high, 50 – 100 times higher than the prevailing background $PM_{2.5}$ concentration, indicating a substantial exposure to airborne fly ash. The highest measured concentration for silica, a human carcinogen, exceeds the ACGIH TLV® of 25 µg/m$^3$. The fact that Mr. Kilby worked significant overtime makes his substantial exposures even more serious; if, for example, he worked 80 hours per week rather than 40 it would have doubled his total dose from inhalation and ingestion and reduces the silica TLV® from 25 to 12.5 µg/m$^3$, and then 3 of the 4 silica measurements in the above table would have exceeded the TLV®.

In addition to the air sampling described above, we can look to indirect evidence for his exposures.

**Evidence of Jimmy Kilby's Exposure:**

Mr. Kilby has described his exposure to coal ash while working at the Kingston site. For example, in responding to interrogatories, he recalled being "the third or fourth worker on the [Kingston] site." He recalled that "[t]he Kingston site and everything on it was always covered in coal ash." He explained that the coal ash "got onto all the machines, buildings, and people," and "[t]here was so much ash in the air that it looked like a dust cloud. He stated that the ash on the ground "was so dry that it was easily kicked up into the air," and he "could see the ash floating around in the air" at the site. As he noted, "[e]ven though the water trucks tried to keep the ash on the ground wet, they could not keep it down effectively. It dried out very quickly."

Mr. Kilby explained that coal ash regularly covered him "head to toe." He stated that "[t]he ash was so fine that it stuck to me easily" and "got on [his] face, clothes, and boots." He recalled that it was "difficult to wash [the coal ash] out because it was so fine and [he] was constantly exposed to it. Mr. Kilby stated that the coal ash got "all over [his] skin" and "into [his] ears, eyes, nose, and mouth." He recalled that he "could taste the ash in [his] mouth" and described it being "gritty like sand."

Mr. Kilby stated that his equipment "was always covered in a film of coal ash." He noted that "[t]he ash got inside the cab through the windows, open doors, and the air vents." He explained that whenever he exited his equipment to walk around the site, "coal ash fell off my boots and clothes onto everything" when he returned to his equipment. He recalled that coal ash covered the floorboards and "[i]t was all over the seats, dashboard, and windshield." As he put it, there was "no escaping" the coal ash.

Mr. Kilby explained that he was never given a mask while working at the Kingston site. He stated that he "could not even bring [his] own mask if [he] wanted to because they were not

allowed to be worn on the site." He testified during his deposition that "[a] guy brought [a mask] and . . . wore it and he was told to take it home." He further recalled another worker, John Cox, "wearing a dust mask and then . . . he wasn't allowed to wear it." He stated that none of his personal protective equipment "actually protected [him] from the coal ash."

When returning home each day after working at the Kingston site, Mr. Kilby recalled that he was "still covered in coal ash." He explained that although boot washing stations were on the Kingston site, "they were not effective." He explained that "[a]fter just a couple workers walked through the tubs of water, they were not good for cleaning anything." As a result, he regularly "tracked the coal ash from [his] boots and clothes into [his] personal car and in [his] home."

Based on the foregoing, it is my scientific opinion that Jimmy Kilby, more likely than not, was exposed by inhalation and ingestion to a long-term, continuous, and high intensity dose of coal fly ash during his employment at the Kingston site sufficient to result in numerous negative health effects as supported by the scientific literature.

**ADDENDUM 24: Individualized Exposure Assessment of Glenn Knight**

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by Glenn Archie Knight at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; and Theron Blickenstaff, MD.

**Materials Reviewed:**

With regard to Mr. Knight, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff Knight's Responses to Interrogatories;
- Employment Record for Glenn Knight;
- Personal Air Monitoring Data; and
- August 1, 2017 Deposition of Knight.

**Glenn Knight's Work at the Kingston Coal Ash Recovery Site:**

Union records indicate that Mr. Knight was employed by GUBMK from February 2009 to March 2009 and from March 2011 to December 2013. Mr. Knight estimates that he worked on the Kingston site "for a few months" beginning in January 2009, and from March 2011 to December 2013. Mr. Knight worked as a truck driver, driving an articulated dump truck on and around the Kingston site during those periods. Mr. Knight estimates that "at first" he regularly worked up to seven days a week for approximately twelve hours per day, but then estimates that he regularly worked approximately fifty hours per week.

**Sampling and Testing Relevant to Glenn Knight's Work:**

His work history indicates that Mr. Knight worked in the Articulated Dump Truck Operator SEG. The highest measured concentrations in this SEG are summarized in the table below.

| SEG and year | Total Dust ($\mu g/m^3$) | Resp. PM ($\mu g/m^3$) | Silica ($\mu g/m^3$) |
|---|---|---|---|
| Artic Dump Truck Operator | | | |
| 2009 | 390 | 260 | 13 |
| 2010 | 350 | <42 | <8 |
| 2011 | | 200 | 17 |
| 2012 | | 120 | 13 |
| 2013 | | 62 | |
| 2014 | 200 | | |

These sample results indicate a repeated, substantial exposure to workers in Mr. Knight's SEG. The highest measured RPM concentration, 260 $\mu g/m^3$, is approximately twenty-five times higher than the likely ambient background $PM_{2.5}$ concentration, indicating a substantial exposure to airborne fly ash. The highest measured exposure to silica, a human carcinogen, 17 $\mu g/m^3$, is slightly less than the ACGIH TLV® of 25 $\mu g/m^3$. The fact that Mr. Knight worked significant overtime makes his substantial exposures even more serious; if, for example, he worked 80 hours per week rather than 40 it would have doubled his total dose from inhalation and ingestion and reduces the silica TLV® from 25 to 12.5 $\mu g/m^3$, and then 3 of the 64silica measurements in the above table would have exceeded the TLV®.

In addition to the air sampling described above, we can look to indirect evidence for his exposures.

**Evidence of Glenn Knight's Exposure:**

Mr. Knight has described his exposure to coal ash while working at the Kingston site. For example, in responding to interrogatories, he recalled that his "truck was always covered with coal

ash." He stated that he was "breathing it in all the time." He explained that "[t]he coal ash would get on [his] clothes, on [his] face, and even in [his] nose and mouth."

Mr. Knight explained that "you could see all the [coal] ash in the air like dust storms." He explained that the coal ash was such a problem that he regularly had to call for a water truck to come pour water on the coal ash near where he was working, so as to reduce the dust in the air and so that the dry coal ash would not blow into the air and cover him. He testified during his deposition that the coal ash was present everywhere on the Kingston site, including designated areas where workers could eat their lunches.

Mr. Knight recalled that "[t]he coal ash would be on [his] face because [he] didn't have a mask" while working at the Kingston site. He testified during his deposition that he was "sure" he breathed in coal ash when he was working on the site. He further explained that he "knew [coal ash] wasn't good" for the workers to breathe in. However, he never asked to wear a mask because he "knew other[ workers] had asked and were told they would be laid off if they wore one on site." As he explained during his deposition, "[t]hey didn't want the general public to see [the workers] wearing masks" on the Kingston site. He testified that masks were not even discussed during "pre-job meetings" because wearing masks on the Kingston site was "something that just wasn't talked about."

At some point, Mr. Knight recalled developing breathing problems. As he recalled, after working on the Kingston site, he began to "hav[e] trouble breathing and sleeping." He brought this to the attention of management, including Tom Bock, a Jacobs Engineering Group, Inc. employee. Mr. Knight recalled that Mr. Bock told him on at least one occasion that coal ash safe. He recalled that Mr. Bock stated that "nothing out there [on the site] could harm [the workers]" and that a person "could eat [coal ash] or drink it if [he] wanted to."

Based on the foregoing, it is my scientific opinion that Glenn Knight, more likely than not, was exposed by inhalation and ingestion to a long-term, continuous, and high intensity dose of coal fly ash during his employment at the Kingston site sufficient to result in numerous negative health effects as supported by the scientific literature.

**<u>ADDENDUM 25: Individualized Exposure Assessment of Clint Mannis</u>**

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by Clint Mannis at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; and Norman Latov, MD.

**Materials Reviewed:**

With regard to Mr. Mannis, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff Clint Mannis' Responses to Interrogatories;
- Employment Records for Clint Mannis;
- Personal Air Monitoring Data; and
- August 11, 2017 Deposition of Clint Mannis.

**Clint Mannis' Work at the Kingston Coal Ash Recovery Site:**

Union records indicate that Mr. Mannis was employed by GUBMK from February 25, 2010 to December 1, 2011. Mr. Mannis estimates he worked on the Kingston site from February 2010 to December 2011. Mr. Mannis worked a variety of jobs on the Kingston site. He worked as a heavy equipment operator, operating an amphibious track hoe, a bulldozer, and other heavy machinery on and around the Kingston site. He also worked on dredging. Mr. Mannis estimates that he worked for up to approximately fourteen hours per day, due to overtime, during this period from February 2010 to December 2011.

**Sampling and Testing Relevant to Clint Mannis' Work:**

Based on his work history, air sampling done for the SEGs Amphibious Excavator Operator and Dozer Operator are relevant to Mr. Mannis' work at the Kinston site. The highest measured concentrations in each SEG are summarized in the table below.

| SEG and year | Total Dust (µg/m$^3$) | Resp. PM (µg/m$^3$) | Silica (µg/m$^3$) |
|---|---|---|---|
| Amphibious Excavator Op | | | |
| 2009 | 1200 | 550 | 41 |
| 2010 | 270 | 110 | 16 |
| 2011 | | 240 | 7 |
| 2012 | | 44 | |
| 2013 | | 62 | |
| Dozer Operator | | | |
| 2009 | 1300 | 210 | 18 |
| 2010 | 930 | 58 | |
| 2011 | | 200 | 26 |
| 2012 | | 77 | |
| 2013 | | 61 | |

These measurements indicate very high exposures to these SEGs. The TPM and RPM measurements in 2009 and 2010 represent exposures that were approximately 5 – 50 times higher than the prevailing background $PM_{2.5}$ concentration, indicating a substantial exposure to airborne fly ash. The two highest measured concentrations for silica, a human carcinogen, both exceed the ACGIH TLV® of 25 µg/m$^3$.

In addition to the air sampling described above, we can look to indirect evidence for his exposures.

**Evidence of Clint Mannis' Exposure:**

Mr. Mannis has described his exposure to coal ash while working at the Kingston site. For example, in responding to interrogatories, he explained that the Kingston site was "like nothing you've ever seen in your life. It looked like a different planet." He recalled that "[e]verything was

completely coated in coal ash almost all the time; our food, our bathrooms, our cabs, our personal vehicles. There was no way to escape [the coal ash].”

Mr. Mannis recalled that the cab of his heavy equipment was “always coated in coal ash.” He noted that this was “especially bad” in the winter “because it was muddier and we’d track [coal ash] into the cab.” He recalled that once the mud dried, it turned into “dry dust” and would “just be floating inside” the cab, which he then breathed in. He further recalled that when he would eat his meals at a break area situated “in the middle” of the Kingston site, his food would regularly be covered in coal ash. “The wind would gust or a truck would drive by and suddenly your whole meal would be covered in ash.” He testified that the coal ash was so prevalent that “[y]ou could wipe the tables down and within ten or 15 minutes you could come back and wipe that table down again and still have ash.”

Mr. Mannis explained that he was regularly “coated in coal ash from head to toe when [he] was at work and when [he] left work.” He explained, “There was no way to get clean after your shift. There were no showers, no place to change clothes, and no place to even wash your hands.” As a result, he recalled “tracking the coal ash mud into [his] personal truck and into [his] house.” When he returned home following his shift at the Kingston site, he was “coated in coal ash mud.”

Mr. Mannis recalled that his “wife said that the coal ash mud was always caked onto the bottom part of [his] pants, and sometimes it would be an inch thick. She said that she could see it all over [his] face and in [his] hair when [he] came home.” He testified in his depositions that she told him on “quite a few” occasions, “You’re not coming in my home. Looks like you’ve rolled in this [coal ash] stuff.” Mr. Mannis recalled that his wife washed his clothes and that she regularly “reach[ed] in and pull[ed] out a wad of gray muck” following each laundry load of his work clothes. He noted that “[t]he coal ash destroyed my washing machine and [they] had to buy a new

one." He explained that "[w]ashing the coal ash off of me in [his home's] shower turned the base of [his] shower completely black and permanently stained it," which required replacement. Mr. Mannis explained that "[t]he coal ash particles [weren't] the same as regular every-day dust; they're really fine and shiny instead of dull." He noted that he "had to rip the carpet out because there was no way to keep it clean" of coal ash. He explained that his grandchildren crawled over the carpet and he was concerned about their exposure to the coal ash dust.

Mr. Mannis testified that he asked Tom Bock, a Jacobs Engineering Group, Inc. employee, "why aren't we suited up or . . . why don't we have dust masks." Mr. Mannis recalled that Mr. Bock simply replied, "Well, you don't need [masks] out here [on the Kingston site]. We don't provide them. You don't need them. Don't ask for them." Mr. Mannis spoke with other workers who relayed that they had also requested dust masks and were likewise denied. As he testified, Mr. Mannis believed that due to the prevalence of coal ash on the Kingston site, "they should have had us set up with full face masks with clean oxygen for us to breathe." However, as he explained, no masks or respirators were provided to the workers on the Kingston site.

Based on the foregoing, it is my scientific opinion that Clint Mannis, more likely than not, was exposed by inhalation and ingestion to a long-term, continuous, and high intensity dose of coal fly ash during his employment at the Kingston site sufficient to result in numerous negative health effects as supported by the scientific literature.

**ADDENDUM 26: Individualized Exposure Assessment of Michael J. McCarthy**

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by Michael J. McCarthy at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; and Sanjay Rajagopalan, MD.

**Materials Reviewed:**

With regard to Mr. McCarthy, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff Michael McCarthy's Responses to Interrogatories;
- Personal Air Monitoring Data;
- April 11, 2017 Deposition of Jeffrey Brewer;
- February 10, 2017 Deposition of Michael McCarthy;
- October 14, 2020 Deposition of Michael McCarthy; and
- Trial Testimony of Ernestine Sargent.

**Michael McCarthy's Work at the Kingston Coal Ash Recovery Site:**

Mr. McCarthy estimates that he worked on the Kingston site from December 26, 2008 to December 2013. Mr. McCarthy worked as a heavy equipment operator, operating a bulldozer and other heavy machinery on and around the Kingston site during that period. Mr. McCarthy also held the position of peer safety champion on the Kingston site, which involved interfacing with workers on the site regarding their safety. Mr. McCarthy estimates that he worked up to approximately

sixteen hours per day, due to overtime, in the weeks and months immediately following the coal ash spill. Following that, he continued to work regularly at the Kingston site.

**Sampling and Testing Relevant to Michael McCarthy's Work:**

Based on his work history, air sampling done for the SEGs Excavator Operator and Dozer Operator are relevant to Mr. McCarthy's work at the Kinston site. The highest measured concentrations in each SEG are summarized in the table below.

| SEG and year | Total Dust (µg/m$^3$) | Resp. PM (µg/m$^3$) | Silica (µg/m$^3$) |
|---|---|---|---|
| Excavator Operator | | | |
| 2009 | 210 | 69 | |
| 2010 | 1400 | | |
| 2011 | | 690 | 18 |
| 2012 | | 520 | |
| 2013 | | 1100 | 7 |
| 2014 | 240 | | |
| Dozer Operator | | | |
| 2009 | 1300 | 210 | 18 |
| 2010 | 930 | 58 | |
| 2011 | | 200 | 26 |
| 2012 | | 77 | |
| 2013 | | 61 | |

These measurements indicate very high exposures to these SEGs. The TPM measurements represent very high exposures to total particle mass, and the RPM measurements for the Excavators in 2011-2013 are very high, approximately 50 – 100 times higher than the prevailing background $PM_{2.5}$ concentration, indicating a substantial exposure to airborne fly ash. The highest measured concentration for silica, a human carcinogen, exceeds the ACGIH TLV® of 25 µg/m$^3$. The fact that Mr. McCarthy worked significant overtime makes his substantial exposures even more serious; if, for example, he worked 80 hours per week rather than 40 it would have doubled his total dose from inhalation and ingestion and reduces the silica TLV® from 25 to 12.5 µg/m$^3$, and then 3 of the 4 silica measurements in the above table would have exceeded the TLV®.

In addition to the air sampling described above, we can look to indirect evidence for his exposures.

**Evidence of Michael McCarthy's Exposure:**

Mr. McCarthy has described his exposure to coal ash while working at the Kingston site. For example, in responding to interrogatories, Mr. McCarthy described the Kingston site as "like being on [M]ars." He explained that he "had been to that area previously" and, following the coal ash spill, "it was unrecognizable." He explained that shortly after the coal ash spill, he would see "[t]he ash was still moving down the river" and "[i]t kept spreading out further with time." He noted that "[d]ust was everywhere and coated everything."

Mr. McCarthy explained that he "worked in all areas of the [Kingston] site." He noted that he "would go into some of the worst working conditions" on the Kingston site. Despite this, he explained that "[t]here was nothing blocking me from the coal ash because they wouldn't let us wear masks." Mr. McCarthy testified that he believed that some masks had been removed from the "supply trailer" on the Kingston site by Ernestine Sargent, an employee of G-UB-MK Constructors. Ms. Sargent confirmed this to Mr. McCarthy, and she testified at trial that she removed these masks from the Kingston site at the urging of Tom Bock, a Jacobs Engineering Group, Inc. employee. When Mr. McCarthy asked whether he could wear a mask on the site, Chris Eich, a Jacobs Engineering Group, Inc. employee, told Mr. McCarthy "[t]hat [he] would be hanging [him]self . . . by [his] own genitals." Other workers, including Ansol Clark and Jeffrey Brewer, witnessed this conversation between Mr. McCarthy and Mr. Eich and have confirmed that Mr. McCarthy was denied the opportunity to wear a mask. In short, Mr. McCarthy and other workers were threatened with retaliation if they were caught wearing masks on the Kingston site.

Mr. McCarthy explained that coal ash mud would "cake" his boots. Although there were boot washing stations on the Kingston site, he noted that "[i]n the winters, the boot washes would be completely frozen" and thus were unusable. Inside the cab of his heavy machinery, he would see "the ash [] flake off our boots." He also explained that "[t]he ash/dust would go airborne anytime you hit a bump, and you could see it floating in the cab." Mr. McCarthy explained that there was "never [] any real way to get the coal ash off of our bodies, hands, or clothes. There was no running water or wipes." He states that the workers often ate their meals in open areas, and "[a]nytime a truck rolled by or the wind gusted, [his] lunch would be coated in ash." He explained that he "constantly had this awful taste in [his] mouth," which he described as tasting metallic, like aluminum foil.

Mr. McCarthy recalled that he would leave the Kingston site each workday "coated from head to toe" with "ash in [his] hair, nose, and ears." "[His] body and face would be covered in the [coal ash]." He explained that he would blow "black stuff out of [his] nose from the time that I got off of my shift until the time I started the next shift." In short, even when not on the Kingston site, he was still affected constantly by the coal ash. He recalled that his house was "coated in coal ash" with "no real way to prevent it." He worried that he was exposing his two infant children and his wife to the coal ash because he was "coated" in it.

Based on the foregoing, it is my scientific opinion that Michael McCarthy, more likely than not, was exposed by inhalation and ingestion to a long-term, continuous, and high intensity dose of coal fly ash during his employment at the Kingston site sufficient to result in numerous negative health effects as supported by the scientific literature.

**ADDENDUM 27: Individualized Exposure Assessment of Jean Nance**

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by Jean Nance at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; C. Ola Landgren, MD, PhD; and Raajit Rampal, MD, PhD.

**Materials Reviewed:**

With regard to Ms. Nance, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff Judy Ivens' Responses to Interrogatories;
- Personal Air Monitoring Data;
- August 17, 2020 Deposition of Judy Ivens;
- October 26, 2020 Deposition of Mike Bledsoe;
- November 5, 2020 Deposition of Stanley Hill;
- October 9, 2020 Declaration of Mike Bledsoe;
- October 9, 2020 Declaration of Stanley Hill; and
- Trial Testimony of Thomas Bock.

**Jean Nance's Work at the Kingston Coal Ash Recovery Site:**

It is estimated that Ms. Nance worked on the Kingston site from December 2008 to March 2012. Ms. Nance held an administrative/logistics position, which required her to work on the Kingston site during that period. Ms. Nance began working in this position in the days following

the December 22, 2008 coal ash spill, and she was among the first workers to begin work on the Kingston site. Her job duties required her to frequently meet with employees, contractors, and other workers on the Kingston site. Ms. Nance worked in one of the trailers, which were utilized as make-shift offices at the Kingston site, located in the area known as “trailer city” near the exclusion zone. It is estimated that Ms. Nance worked four days a week for approximately ten hours per day, or more due to overtime, during this period.

**Sampling and Testing Relevant to Jean Nance’s Work:**

Ms. Nance’s SEG was Management/Administration. Unfortunately, only 6 workers in this SEG were monitored over the entire monitoring period. However, due to evidence, described below, that Ms. Nance spend considerable time walking throughout the exclusion zone, the other site-wide support staff SEGs, i.e., Field Staff and Sample Technician, likely are relevant to her exposures. The highest measured concentrations in each of these SEGs are summarized in the table below.

| SEG and year | Total Dust (μg/m$^3$) | Resp. PM (μg/m$^3$) | Silica (μg/m$^3$) |
|---|---|---|---|
| Field Staff | | | |
| 2010 | | <44 | |
| 2011 | | 220 | 14 |
| 2012 | | 27 | |
| 2013 | | 77 | |
| 2014 | 180 | 47 | |
| Management/Admin | | | |
| 2009 | 290 | 67 | |
| Sample Technician | | | |
| 2010 | <190 | <134 | |
| 2011 | | 560 | 19 |
| 2012 | | 920 | 23 |

These sample results, in particular those for sample technicians, whose job it was to travel around the entire site monitoring workers and collect samples, confirm the likelihood that Ms. Nance was exposed to substantially elevated levels of airborne fly ash and its toxic constituents

when she was required to leave her work trailer. While in her trailer, the absence of relevant air sampling requires us to rely on other evidence for her likely exposures, as discussed below.

**Evidence of Jean Nance's Exposure:**

Ms. Nance died on September 25, 2015 and cannot describe her own exposure to the coal ash. However, other workers, such as Michael Bledsoe and Stanley Hill, have explained that they met Ms. Nance through their work at the Kingston site. Mr. Bledsoe and Mr. Hill submitted declarations regarding their knowledge of Ms. Nance's exposure to coal ash, which they each confirmed in their depositions. They explained that Ms. Nance worked in a trailer located in "trailer city," which was located outside the exclusion zone but still on the Kingston site, and that she performed various administrative tasks, including creating badges for the workers on the Kingston site. Mr. Bledsoe explained that Ms. Nance wore regular "street clothes" and "non-work boots." Mr. Bledsoe and Mr. Hill testified during their depositions that Ms. Nance's desk was immediately to the right when you walk into the trailer.

In their declarations, Mr. Bledsoe and Mr. Hill estimated that numerous workers would visit with Ms. Nance every day and that these "workers tracked the coal ash from their boots and clothes inside and all around Jean Nance's trailer." Mr. Hill testified that he regularly took workers to meet with Ms. Nance to obtain badges for working on the Kingston site. Mr. Bledsoe testified that he would visit with Ms. Nance on a regular basis, "probably a couple times a week." Mr. Bledsoe witnessed the coal ash "settle all over the floor of her trailer," even after workers had attempted to wash their boots before entering the trailer. Mr. Bledsoe explained that the coal ash would "spread everywhere in Jean Nance's trailer," and he "could see it floating in the air." On one occasion, Mr. Bledsoe noticed coal ash settling on Ms. Nance's belongings, including some documents she was holding. Mr. Hill testified that he saw coal ash dust on Ms. Nance's table. Mr.

Bledsoe described Ms. Nance's trailer as being the one of the "dirtiest place on the Kingston site" despite being designated as a "clean zone."

In his declaration, Mr. Hill stated that "[t]he constant traffic of dirty work boots and the dry ash floating in the air made Jean Nance's trailer filthy" and her trailer was "covered in fly ash." Mr. Hill saw the coal ash accumulating on the trailer's floor and noticed that it "got on everything, including on Jean Nance's clothing and face." Mr. Hill observed that Ms. Nance likely was "exposed to airborne fly ash as much as, if not more than, many workers who spent their entire shifts in the exclusion zone." As Mr. Hill explained, sometimes the ash inside Ms. Nance's trailer "was so dry and thick in the air" that he sometimes had to cover his nose in order to breathe inside. Mr. Hill explained that the air in and around Ms. Nance's trailer had the same "glittery look" as that seen in the air in the exclusion zone on the Kingston site. However, Mr. Hill explained that "inside Jean Nance's trailer . . . it was often dustier there than in the exclusion zone." Mr. Hill described Ms. Nance's trailer, and particularly the area around her desk, as "one of the most constantly dusty places on the entire site."

During her August 17, 2020 deposition, Ms. Nance's twin sister, Judith Ivens, stated that Ms. Nance's job duties required that she "walk around the coal ash spill site on a regular basis to provide ID badges" and that she was "out a lot just delivering badges" to workers on the Kingston site. Ms. Nance's job duties also required that she notify workers of the results of background checks, which would require that Ms. Nance go out onto the Kingston site to inform affected workers. Further, Ms. Nance's job duties required that she sometimes order supplies and deliver them to those on the Kingston site. Ms. Ivens stated that Ms. Nance was "out in the field walking around quite a bit." Despite Ms. Nance's duties requiring her to be on the Kingston site, Ms. Ivens stated that her knowledge Ms. Nance did not wear personal protective equipment.

Ms. Ivens stated that when Ms. Nance returned home from work at the Kingston site, "[h]er car had a dust film on it." Ms. Ivens explained that the coal ash was visible as a "grayish" dust, both inside and on the outside of Ms. Nance's vehicle. Ms. Ivens described that the vehicle Ms. Nance drove began to smell "different" over the course of her work on the Kingston site. Ms. Ivens further described that she noticed a "sort of film on her clothes" after Ms. Nance returned from work at the Kingston site. Moreover, Ms. Ivens could see coal ash dust in Ms. Nance's hair when she returned from work at the Kingston site.

Ms. Ivens also testified that Ms. Nance would go to work at the Kingston site and would have to "brush off" coal ash from her desk before she could work, and that Ms. Nance kept a lid over her coffee to prevent coal ash from settling in it, and that Ms. Nance often cleaned the coffee pot because of the coal ash dust. Moreover, Plaintiff Ivens explained that Ms. Nance described how she could "taste" the coal ash when she was working at the Kingston site. Just days before she died, Ms. Nance stated that she knew she "wouldn't be in this condition if [she] hadn't gone to work at Kingston."

During trial, Tom Bock, an employee of Jacobs Engineering Group, Inc. who worked on the Kingston site, testified about a complaint regarding one of the trailers in trailer city. This complaint stated that "Large quantities of dust [were seen] in Jacobs' trailer. Need to look into ventilation filters, if any exist, and possibly station air monitors in the office. Dust is fine particulate and could be ash particles which are unsafe to breathe." This complaint specifically mentioned that "large quantities" of dust—and potentially coal ash particles—were visible in one of the Jacobs trailers. One can assume that this trailer was either Ms. Nance's specific trailer, or that it was in close proximity to Ms. Nance's trailer, that they would have been in substantially similar conditions. This complaint is similar to what Mr. Bledsoe and Mr. Hill describe regarding

Ms. Nance's trailer: that coal ash dust was visible, either on the floor, on other surfaces, or in the air. However, just as the complaint notes, no ventilation filters or air monitoring equipment was in use in or around these trailers. In short, it appears that no measures were taken to address the widespread, endemic existence of coal ash in and around the trailers in trailer city, including Ms. Nance's trailer.

Based on the foregoing, it is my scientific opinion that Jean Nance, more likely than not, was exposed by inhalation and ingestion to a long-term, continuous, and high intensity dose of coal fly ash during his employment at the Kingston site sufficient to result in numerous negative health effects as supported by the scientific literature.

**ADDENDUM 28: Individualized Exposure Assessment of Frankie Norris**

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by Frankie Norris at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; and Theron Blickenstaff, MD.

**Materials Reviewed:**

With regard to Mr. Norris, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff Frankie Norris' Responses to Interrogatories;
- Employment Records for Frankie Norris;
- Personal Air Monitoring Data; and
- August 16, 2017 Deposition of Frankie Norris.

**Frankie Norris' Work at the Kingston Coal Ash Recovery Site:**

Union records indicate that Mr. Norris was employed by GUBMK from February 17, 2009 to December 1, 2011 and from August 21, 2012 to October 2, 2012; and by Phillips & Jordan, Inc. from April 15, 2014 to March 11, 2015. Mr. Norris estimates that he worked on the Kingston site from February 2009 to March 2015. Mr. Norris worked as an operator, operating a bulldozer on and around the Kingston site during that period. Mr. Norris also worked "fueling the trucks," required him to work at the Kingston site during that period. Mr. Norris estimates that he regularly

worked up to seven days a week for approximately ten hours per day, during this period from February 2009 to March 2015.

**Sampling and Testing Relevant to Frankie Norris' Work:**

Based on his work history, sampling collected in the following SEGs is relevant to Mr. Norris: Dozer Operator, Fuel Truck Operator. The Water Truck Operator SEG is also relevant to Mr. Norris. The highest measured concentrations in each SEG are summarized in the table below.

| SEG and year | Total Dust (µg/m$^3$) | Resp. PM (µg/m$^3$) | Silica (µg/m$^3$) |
|---|---|---|---|
| Dozer Operator | | | |
| 2009 | 1300 | 210 | 18 |
| 2010 | 930 | 58 | |
| 2011 | | 200 | 26 |
| 2012 | | 77 | |
| 2013 | | 61 | |
| Fuel Truck Operator | | | |
| 2011 | | 320 | 24 |
| Water Truck Operator | | | |
| 2009 | 170 | | |
| 2010 | 380 | 109 | |
| 2011 | | 320 | 24 |
| 2012 | | 150 | 10 |
| 2013 | | 280 | |
| 2014 | | 58 | |

These sample results indicate a repeated, substantial exposure to workers in Mr. Norris' SEGs. The TPM measurements for Dozer Operator indicate very high levels of exposure in this SEG. The highest measured RPM concentration, 320 µg/m$^3$, found in two different SEGs, is approximately thirty times higher than the likely ambient background $PM_{2.5}$ concentration, indicating a substantial exposure to airborne fly ash. The highest measured exposure to silica, a human carcinogen, 26 µg/m$^3$, exceeds than the ACGIH TLV® of 25 µg/m$^3$, and two other silica measurements were just below the TLV®. The fact that Mr. Norris worked significant overtime makes his substantial exposures even more serious; if for example he worked 80 hours per week

rather than 40 it would have doubled his total dose from inhalation and ingestion and reduces the silica TLV® from 25 to 12.5 μg/m$^3$, and then 4 of the 5 silica measurements in the above table would have exceeded the TLV®.

In addition to the air sampling described above, we can look to indirect evidence for his exposures.

**Evidence of Frankie Norris' Exposure:**

Mr. Norris has described his exposure to coal ash while working at the Kingston site. For example, in responding to interrogatories, he stated "[t]he whole time [he] worked at Kingston, coal ash was all over [him]." He explained that "[t]he ash got onto everything on the site including the equipment, trailers, conex boxes, and especially, the workers." He recalled that the coal ash "settled on [his] skin and even got in [his] mouth . . . [and] was also in [his] nose and ears." Mr. Norris stated that he could taste the coal ash and that his wife "could even taste it on [him] at the end of the day when [he] came home." As he put it, "The whole site was covered constantly [in coal ash] . . . [and i]t got in every nook and cranny because it was always floating around in the air on the site."

Mr. Norris stated that he "could see the ash in the air" at the Kingston site. He described the coal ash as being "so fine that it would kick up very easy and get into everything." He explained that "even though [he] wore safety glasses, the ash still got behind the glasses and in [his] eyes." He stated that the coal ash "burned [his] eyes" caused them to become "watery," which still remains a problem to this day.

Mr. Norris recalled regularly eating his lunch "in a conex box with other workers." He explained that "[t]he conex was filthy and ash was all over the floor." Although there were boot washing stations at the Kingston site, they were ineffective as they were just "little pans with

water," which "put more ash on you than they took off." As he described it, "After a few workers used them, the pans looked like a slurry of water and coal ash."

Mr. Norris explained that he regularly "walked around the site . . . and worked in the cab of [his] trucks." He stated, "The ash covered the outside and inside of [his] vehicles. The cabs of [his] work truck and [his] personal truck were also covered in the coal ash." He recalled that "[a]t the end of the day, there was still so much ash on [him] that it got all in [his] personal car [and] was always on the floor and dash and everywhere."

Mr. Norris recalled trying to get coal ash off his clothes at the Kingston site. "[A]fter [the workers] got there, they had this little pan of water and after the first one went in it was – you got more on you than you got off. And your clothes . . . your clothes [were] saturated with [coal ash]." He further stated that the inside of the Kingston site trailers were "excessively dusty." As he described it, coal ash was visible in the air and "you could rub your finger through it and you could see where your finger went."

During his deposition, Mr. Norris testified that he did not wear a dust mask or respirator while working at the Kingston site because he had heard from several people that "they would fire you" for wearing a mask while working at the site. Mr. Norris stated that management did not want people wearing dust masks on the Kingston site because they "[d]idn't want the public seeing [them] for some reason or another." He recalled that, on different occasions, Tom Bock and Chris Eich, both Jacobs Engineering Group, Inc. employees, told him that "you would be fired if [you] asked for a dust mask." He also recalled Mr. Bock and Mr. Eich saying that coal ash was "safe" and that "there was nothing in it that would hurt you." On another occasion, Mr. Norris was told that the workers "could eat eight pounds of [coal ash] a day, [and it] wouldn't hurt [them]."

Based on the foregoing, it is my scientific opinion that Frankie Norris, more likely than not, was exposed by inhalation and ingestion to a long-term, continuous, and high intensity dose of coal fly ash during his employment at the Kingston site sufficient to result in numerous negative health effects as supported by the scientific literature.

**ADDENDUM 29: Individualized Exposure Assessment of Nicholas Perry**

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by Nicholas Perry at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; and Theron Blickenstaff, MD.

**Materials Reviewed:**

With regard to Mr. Perry, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff Nick Perry's Responses to Interrogatories;
- Employment Records for Nicholas Perry;
- Personal Air Monitoring Data; and
- October 19, 2020 Deposition of Nicholas Perry.

**Nicholas Perry's Work at the Kingston Coal Ash Recovery Site:**

Employment records indicate that Mr. Perry worked at the Kingston site from January 2012 to August 2014. Mr. Perry estimates he worked on the Kingston site from January 28, 2012 to August 2014. Mr. Perry worked inside the exclusion zone on the Kingston site as a laborer, cleaning and vacuuming vehicles and equipment daily. These duties required him to work on the Kingston site during that period. Mr. Perry estimates that he regularly worked up to seven days a week for approximately ten hours per day, or more due to overtime, during this period from January 28, 2012 to August 2014.

**Sampling and Testing Relevant to Nicholas Perry's Work:**

Based on his work history, Mr. Perry worked in the General Laborer SEG. The highest measured concentrations in each year in this SEG are shown in the following table.

| SEG and year | Total Dust ($\mu g/m^3$) | Resp. PM ($\mu g/m^3$) | Silica ($\mu g/m^3$) |
|---|---|---|---|
| General Laborer | | | |
| 2009 | 2000 | 570 | 49 |
| 2010 | 2500 | 440 | <9 |
| 2011 | | 190 | 21 |
| 2012 | | 96 | |
| 2013 | | 120 | 16 |
| 2014 | 480 | | |

These sample results indicate a repeated, substantial exposure to workers in Mr. Perry's SEG. The TPM measurements in 2009 and 2010 are among the highest measurement in the entire data set and represent levels that are very difficult to create and maintain in an outdoor environment, since they are approximately 100 times higher than the ambient background TPM levels. The highest measured RPM concentration, 570 $\mu g/m^3$, is approximately fifty times higher than the likely ambient background $PM_{2.5}$ concentration, indicating a substantial exposure to airborne fly ash. The highest measured exposure to silica, a human carcinogen, 49 $\mu g/m^3$, is twice the ACGIH TLV® of 25 $\mu g/m^3$.

The fact that Mr. Perry worked significant overtime makes his substantial exposures even more serious; if, for example, he worked 80 hours per week rather than 40 it would have doubled his total dose from inhalation and ingestion and reduces the silica TLV® from 25 to 12.5 $\mu g/m^3$, and then 3 of the 4 silica measurements in the above table would have exceeded the TLV®.

In addition to the air sampling described above, we can look to indirect evidence for his exposures.

**Evidence of Nicholas Perry's Exposure:**

Mr. Perry has described his exposure to coal ash while working at the Kingston site. For example, in responding to interrogatories, he explained that he "was constantly standing and walking in coal ash." He stated that his "face would be covered in ash all day and when [he] came home."

Mr. Perry recalled that there were "soft spots" on the Kingston site that he could sink down into. During his deposition, he testified that on at least one occasion"[he] fell in some [coal ash] and they had to scoop [him] out with an excavator." He explained that the coal ash "ate the leather on [his] boots." He testified that at the end of his shift "[m]ost of the time the front of [his clothes] was pretty dusty." He recalled that when he came home each day after working at the Kingston site, he would take his clothes off in the garage and "ash would just fall off of them and [his body] all over the floor."

Mr. Perry explained that "the ash got up inside" his gloves regularly, causing his hands to become "dirty from the ash." He stated that regularly there was "[a]sh in [his] facial area, in [his] ears, the stuff from where it blew during the day." Despite this, he explained that he did not wear a mask while working on the Kingston site "aside from a plastic face mask when weed eating" or when vacuuming equipment on the site. He testified, "A coupled [workers] had been let go for asking for a respirator." In particular, Mr. Perry testified that Kevin Thompson, a worker on the Kingston site, was rumored to have been fired for wearing a dust mask at the site.

Based on the foregoing, it is my scientific opinion that Nicholas Perry, more likely than not, was exposed by inhalation and ingestion to a long-term, continuous, and high intensity dose of coal fly ash during his employment at the Kingston site sufficient to result in numerous negative health effects as supported by the scientific literature.

**ADDENDUM 30: Individualized Exposure Assessment of James Phillips**

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by James Phillips at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; and Theron Blickenstaff, MD.

**Materials Reviewed:**

With regard to Mr. Phillips, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff James Phillips' Responses to Interrogatories;
- Personal Air Monitoring Data; and
- October 16, 2020 Deposition of James Phillips.

**James Phillips' Work at the Kingston Coal Ash Recovery Site:**

Mr. Phillips estimates that he worked on the Kingston site from 2009 to 2013. Mr. Phillips worked various jobs on the Kingston site, including: as a laborer with a dredging crew, cleaning equipment, and working at the "car wash" on the site. These jobs required him to work in the exclusion zone at the Kingston site during that period. Mr. Phillips estimates that he regularly worked up to seven days a week for approximately ten hours per day, or more due to overtime, during this period from 2009 to 2013.

**Sampling and Testing Relevant to James Phillips' Work:**

Based on his work history, Mr. Phillips worked in the General Laborer SEG. The highest measured concentrations in each year in this SEG are shown in the following table.

| SEG and year | Total Dust (μg/m$^3$) | Resp. PM (μg/m$^3$) | Silica (μg/m$^3$) |
|---|---|---|---|
| General Laborer | | | |
| 2009 | 2000 | 570 | 49 |
| 2010 | 2500 | 440 | <9 |
| 2011 | | 190 | 21 |
| 2012 | | 96 | |
| 2013 | | 120 | 16 |
| 2014 | 480 | | |

These sample results indicate a repeated, substantial exposure to workers in Mr. Phillip's SEG. The TPM measurements in 2009 and 2010 are among the highest measurement in the entire data set and represent levels that are very difficult to create and maintain in an outdoor environment, since they are approximately 100 times higher than the ambient background TPM levels. The highest measured RPM concentration, 570 μg/m$^3$, is approximately fifty times higher than the likely ambient background $PM_{2.5}$ concentration, indicating a substantial exposure to airborne fly ash. The highest measured exposure to silica, a human carcinogen, 49 μg/m$^3$, is twice the ACGIH TLV® of 25 μg/m$^3$.

The fact that Mr. Phillips worked significant overtime makes his substantial exposures even more serious; if, for example, he worked 80 hours per week rather than 40 it would have doubled his total dose from inhalation and ingestion and reduces the silica TLV® from 25 to 12.5 μg/m$^3$, and then 3 of the 4 silica measurements in the above table would have exceeded the TLV®.

In addition to the air sampling described above, we can look to indirect evidence for his exposures.

**Evidence of James Phillips' Exposure:**

Mr. Phillips has described his exposure to coal ash while working at the Kingston site. For example, in responding to interrogatories, he explained that "[he] was covered in ash all the time" and "[he] was always in it." He recalled that the coal ash "coated [his] skin and dried it out to." He further recalled that "could taste the ash in the air all the time" and that the coal ash "would get in [his] mouth and eyes every day." Mr. Phillips stated that the Kingston site was "so dusty that you couldn't even see the machinery working at times." He recalled that he sunk "knee deep" in the coal ash on several occasion and that he "had a hard time getting out of it."

Mr. Phillips recalled that his car "also got covered in ash." When he returned home each day after working at the Kingston site, he "tried to take [his] clothes off outside . . . because they would be so dirty." He recalled that he had to replace his washing machine because he had used it to regularly wash his work clothes. He further stated, "When [he] took a shower, the water would be grey from all the ash."

In his deposition, Mr. Phillips reiterated that the Kingston site was "very dusty" and noted that the ash "dried your skin out real bad." He testified that he never wore a mask while working at the Kingston site and that "they didn't even have them." He further explained, "They didn't even want [the workers] to ask for [masks]" to wear while working on the site. As he put it, "they said if you were asking for masks and stuff, that's probably the best way to get out of a job."

After developing some shortness of breath while working at the Kingston site., Mr. Phillips spoke with Tom Bock, a Jacobs Engineering Group, Inc. employee, who told Mr. Phillips that "the ash was not . . . what was making [him] sick and it was safe and it wouldn't hurt [him]." Mr. Phillips recalled Mr. Bock stating that "you could eat [coal ash] and be fine." In fact, Mr. Phillips he witnessed Mr. Bock making these statements "several" workers that coal ash was safe.

Based on the foregoing, it is my scientific opinion that James Phillips, more likely than not, was exposed by inhalation and ingestion to a long-term, continuous, and high intensity dose of coal fly ash during his employment at the Kingston site sufficient to result in numerous negative health effects as supported by the scientific literature.

**ADDENDUM 31: Individualized Exposure Assessment of Joseph Pursiful**

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by Joseph Pursiful at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; and Theron Blickenstaff, MD.

**Materials Reviewed:**

With regard to Mr. Pursiful, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff Joseph Pursiful's Responses to Interrogatories;
- Employment Records for Joseph Pursiful;
- Personal Air Monitoring Data;
- October 8, 2020 Deposition of Brenda Pursiful; and
- August 18, 2017 Deposition of Joseph Pursiful.

**Joseph Pursiful's Work at the Kingston Coal Ash Recovery Site:**

Union records indicate that Mr. Pursiful was employed by GUBMK from December 2008 to August 2013. Mr. Pursiful estimates that he worked on the Kingston site from December 27, 2008 to August 9, 2013. Mr. Pursiful worked inside the exclusion zone on the Kingston as a truck driver, driving a dump truck and a water truck on and around the Kingston site. Mr. Pursiful estimates that he regularly worked up to seven days a week for approximately twelve hours per

day, which was later reduced to approximately ten hours per day, during this period from December 27, 2008 to August 9, 2013.

**Sampling and Testing Relevant to Joseph Pursiful's Work:**

Based on his work history, sampling collected in the following SEGs is relevant to Mr. Pursiful: Dump Truck Operator, Water Truck Operator. The highest measured concentrations in each SEG are summarized in the table below.

| SEG and year | Total Dust (μg/m$^3$) | Resp. PM (μg/m$^3$) | Silica (μg/m$^3$) |
|---|---|---|---|
| Dump Truck Operator | | | |
| 2009 | 360 | 260 | 13 |
| 2010 | | 95 | |
| 2011 | | 51 | |
| 2012 | | 36 | |
| Water Truck Operator | | | |
| 2009 | 170 | | |
| 2010 | 380 | 109 | |
| 2011 | | 320 | 24 |
| 2012 | | 150 | 10 |
| 2013 | | 280 | |
| 2014 | | 58 | |

These sample results indicate a repeated, substantial exposure to workers in Mr. Pursiful's SEGs. The highest measured RPM concentration, 320 μg/m$^3$, is approximately thirty times higher than the likely ambient background $PM_{2.5}$ concentration, indicating a substantial exposure to airborne fly ash. The highest measured exposure to silica, a human carcinogen, 24 μg/m$^3$, is just slightly less than the ACGIH TLV® of 25 μg/m$^3$. The fact that Mr. Pursiful worked significant overtime makes his substantial exposures even more serious; if, for example, he worked 80 hours per week rather than 40 it would have doubled his total dose from inhalation and ingestion and reduces the silica TLV® from 25 to 12.5 μg/m$^3$, and then 5 of the 7 silica measurements in the above table would have exceeded the TLV®.

In addition to the air sampling described above, we can look to indirect evidence for his exposures.

**Evidence of Joseph Pursiful's Exposure:**

Mr. Pursiful described his exposure to coal ash while working at the Kingston site. For example, in responding to interrogatories, he stated that "[t]here was always coal ash everywhere you went at the [Kingston] site; you could never get away from it." He recalled regularly being "covered from head to toe in the ash" and that "[he] could taste it." As he described it, "It did not matter where you went, or where you took your break, there was always ash coating every surface." He stated that "[h]e would have it on [his] hands, face, nose, eyes, ears, and hair." He recalled "cough[ing] or sneez[ing] and brownish dark muc[us] would come out."

Mr. Pursiful described the Kingston site as "like a big dust bowl." He explained that workers "would wet the ash down, but it would get dusty as soon as the sun hit the ash." He recalled being told to "wet down stationary monitors because it helped make it seem like it wasn't too dusty to work." However, Mr. Pursiful explained that "[i]t was always dusty."

Mr. Pursiful noted that it was difficult to keep his truck clean because of the dust. He stated, "With time, my white truck turned yellow from constantly being coated in the ash." He testified during his deposition that "no matter how tight you kept your windows and kept your filters blew out, [coal ash] would still build up [and] would get in the cab." He recalled that when he returned home each day after working at the Kingston site, "the coal ash ended up staining" his house.

Mr. Pursiful's wife, Brenda Pursiful, testified in her deposition that she visited Mr. Pursiful near the Kingston site and noticed that his shoes and pants covered in "white dust." She further testified that when Mr. Pursiful came home after working at the Kingston site "[h]e still had the white dust on his clothes, particularly around his shoes, the bottom of his pants area."

During his deposition, Mr. Pursiful testified that he voiced some "concerns" about his health to Tom Bock, a Jacobs Engineer Group, Inc. employee, but he "was denied." He recalled Mr. Bock stating, "[Y]ou could eat a pound of [coal ash] a day. Don't breathe it." Mr. Pursiful understood that to mean that coal ash was not hazardous to be around at the Kingston site. Mr. Pursiful explained that he stopped wearing a mask after approximately three weeks on the job because he was advised that coal ash was safe.

Based on the foregoing, it is my scientific opinion that Joseph Pursiful, more likely than not, was exposed by inhalation and ingestion to a long-term, continuous, and high intensity dose of coal fly ash during his employment at the Kingston site sufficient to result in numerous negative health effects as supported by the scientific literature.

**ADDENDUM 32: Individualized Exposure Assessment of Ralph Ramey**

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by Ralph Ramey at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; and Theron Blickenstaff, MD.

**Materials Reviewed:**

With regard to Mr. Ramey, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff Ralph Ramey's Responses to Interrogatories;
- Personal Air Monitoring Data;
- September 29, 2020 Deposition of James Patterson; and
- August 13, 2020 Deposition of Ralph Ramey.

**Ralph Ramey's Work at the Kingston Coal Ash Recovery Site:**

Mr. Ramey estimates that he worked on the Kingston site from early 2009, shortly after the coal ash spill occurred, to 2012. Mr. Ramey worked inside the exclusion zone on the Kingston site as a truck driver, hauling rock and other materials on and around the Kingston site during that period. Mr. Ramey estimates that he worked six days a week for approximately ten hours per day, or more due to overtime, during this period from early 2009 to 2012. Mr. Ramey's brother, James Patterson, who was the co-owner of Big Springs Farms Excavating & Trucking, stated that Mr.

Ramey worked seven days a week for approximately fourteen hours per day while working at the Kingston site from early 2009 to 2012.

**Sampling and Testing Relevant to Ralph Ramey's Work:**

Mr. Ramey's work history indicates that he worked in the Dump Truck Operator SEG. The highest measured concentration in each year for this SEG are shown in the following table.

| SEG and year | Total Dust ($\mu g/m^3$) | Resp. PM ($\mu g/m^3$) | Silica ($\mu g/m^3$) |
|---|---|---|---|
| Dump Truck Operator | | | |
| 2009 | 360 | 260 | 13 |
| 2010 | | 95 | |
| 2011 | | 51 | |
| 2012 | | 36 | |

The sample results show that dump truck drivers such as Mr. Ramey were consistently exposed to airborne RPM concentrations that were elevated, with the highest value about 25 times higher than the prevailing background $PM_{2.5}$ concentration, indicating a substantial exposure to airborne fly ash. The fact that Mr. Ramey worked significant overtime makes his substantial exposures even more serious; if, for example, he worked 80 hours per week rather than 40 it would have doubled his total dose from inhalation and ingestion and reduced the silica TLV® from 25 to 12.5 $\mu g/m^3$, and then the silica measurement in the above table would have exceeded the TLV®.

In addition to the air sampling described above, we can look to indirect evidence for his exposures.

**Evidence of Ralph Ramey's Exposure:**

Mr. Ramey has described his exposure to coal ash while working at the Kingston site. For example, in responding to interrogatories, he stated that the "coal ash was everywhere and always covered [him] when [he] worked at the site." He recalled, "When [he] got out of [his] truck, [his] boots got covered in wet ash . . . [w]hen [he] got back into [his] cab, the ash from [his] boots got

all over the floorboard. [He] had to sweep out the cab of [his] truck often because so much ash from [his] boots and from the ash in the air got inside." He explained that the "dry ash made the air on the site very dusty" and "was so thick with fly ash that it was hazy all the time." He further added that "[w]hen [he] showered after work, so much ash would come off [his] body that the water in the tub was black."

During Mr. Ramey's deposition, he testified that at the end of the day he would have coal ash on his clothes, arms, hands, and face to the point where "[he]'d be black" with dust. Despite this, he did not have "access to the washing stations with the water bottles and the boot washes." He explained that he had both inhaled and ingested coal ash on a regular basis while at the Kingston site. Mr. Ramey stated that he did not wear a mask while working on the Kingston site, and he did not recall other workers wearing masks while working on the site.

Ralph Ramey's brother and business co-owner, James Patterson, testified that he and Mr. Ramey started working at the Kingston site soon after the ash spill occurred: "[I]t was a disaster. All of Swan Pond Road was covered with ash . . . We were all over the site. We weren't in no particular place. We worked for a long time on site, the trucks did. We drove right out into the ash for days." Mr. Patterson further described the roads that he and Mr. Ramey drove on as having "ash all over it. That whole valley was full of ash material, and [they] were travelling through it."

Mr. Patterson recalled that truck washes on the Kingston site were essentially "just like spraying ash mud on the windows of them . . . [they]'d have to stop and wipe the windows because [they] couldn't see to travel once the washers even washed [the truck] because the water was contaminated filthy." Mr. Patterson stated that the truck washes never improved during their time at the Kingston site and that "[i]t was a filmy nasty wash every time [they] went through it" due to the coal ash.

Mr. Patterson testified that he would see Mr. Ramey at the end of most work days at the Kingston site and described his clothes as “filthy.” He noted that “[e]verybody was filthy, dusty, filthy.” Mr. Patterson stated that “masks wasn’t required. They said it was not a hazardous site . . . [and] they didn’t like you to wear the masks because it put off a bad vibe.” He also “asked the guy at Jacobs if mask . . . were required to wear them and did we need to wear them, and he said it wasn’t a hazardous site.”

Based on the foregoing, it is my scientific opinion that Ralph Ramey, more likely than not, was exposed by inhalation and ingestion to a long-term, continuous, and high intensity dose of coal fly ash during his employment at the Kingston site sufficient to result in numerous negative health effects as supported by the scientific literature.

## **ADDENDUM 33: Individualized Exposure Assessment of Jimmy Roberts**

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by Jimmy Roberts at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; and Theron Blickenstaff, MD.

**Materials Reviewed:**

With regard to Mr. Roberts, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff Jimmy Roberts' Responses to Interrogatories;
- Employment Records for Jimmy Roberts;
- Personal Air Monitoring Data; and
- August 13, 2020 Deposition of Jimmy Roberts.

**Jimmy Roberts' Work at the Kingston Coal Ash Recovery Site:**

Employment records indicate that Mr. Roberts was employed by TransAsh Inc. from June 2009 to August 2009; by Sevenson Environmental from March 2010 to May 2010; and by GUBMK from February 2011 to December 2013. Mr. Roberts estimates that he worked on the Kingston site from June 2009 to December 2013. Mr. Roberts worked in the exclusion zone on the site as a truck driver, driving an off-road truck, a water truck, a fuel truck, and a "low boy" on and around the Kingston site during those periods. Mr. Roberts estimates that he regularly worked six days a week for approximately ten hours per day, or more due to overtime, during those periods.

**Sampling and Testing Relevant to Jimmy Roberts' Work:**

Based on his work history, sampling collected in the following SEGs is relevant to Mr. Roberts: Articulated Dump Truck Operator, Dump Truck Operator, Fuel Truck Operator, Water Truck Operator. Fuel truck operators were only monitored in 2011 and 2012. The highest measured concentrations in each SEG are summarized in the table below.

| SEG and year | Total Dust (µg/m$^3$) | Resp. PM (µg/m$^3$) | Silica (µg/m$^3$) |
|---|---|---|---|
| Artic Dump Truck Operator | | | |
| 2009 | 390 | 260 | 13 |
| 2010 | 350 | <42 | <8 |
| 2011 | | 200 | 17 |
| 2012 | | 120 | 13 |
| 2013 | | 62 | |
| 2014 | 200 | | |
| Dump Truck Operator | | | |
| 2009 | 360 | 260 | 13 |
| 2010 | | 95 | |
| 2011 | | 51 | |
| 2012 | | 36 | |
| Fuel Truck Operator | | | |
| 2011 | | 320 | 24 |
| 2012 | | 38 | |
| Water Truck Operator | | | |
| 2009 | 170 | | |
| 2010 | 380 | 109 | |
| 2011 | | 320 | 24 |
| 2012 | | 150 | 10 |
| 2013 | | 280 | |
| 2014 | | 58 | |

These sample results indicate a repeated, substantial exposure to workers in Mr. Roberts' SEGs. The highest measured RPM concentration, 320 µg/m$^3$, measured for both his work as fuel truck and water truck driver, is approximately thirty times higher than the likely ambient background $PM_{2.5}$ concentration, indicating a substantial exposure to airborne fly ash. The highest

measured exposure to silica, a human carcinogen, 24 μg/m$^3$, again measured for two of his jobs, is just slightly below the ACGIH TLV® of 25 μg/m$^3$. The fact that Mr. Roberts worked significant overtime makes his substantial exposures even more serious; if for example he worked 80 hours per week rather than 40 it would have doubled his total dose from inhalation and ingestion and reduces the silica TLV® from 25 to 12.5 μg/m$^3$, and then 6 of the 8 silica measurements in the above table would have exceeded the TLV®.

In addition to the air sampling described above, we can look to indirect evidence for his exposures.

**Evidence of Jimmy Roberts' Exposure:**

Mr. Roberts has described his exposure to coal ash while working at the Kingston site. For example, in responding to interrogatories, he explained that "[a]t the Kingston site, [his] body was always covered in coal ash." He explained that the coal ash "got all on [his] clothes and all over [his] skin" and "got down in [his] ear and nose." As he recalled, "When [he] blew [his] nose, black mucus would come out on a regular basis." He further explained that coal ash regularly got in his eyes, even though he wore safety glasses.

Mr. Roberts also explained that "[he] had to walk around [the Kingston site]" and the coal ash would "stick to [his] boots and the bottom of [his] pants." He recalled "[t]here were a lot of dust storms kicking up the ash into the air" because "[t]he water trucks were always going but they could not keep [the coal ash] down." As he stated, "the ash from outside was so thick in the air that it flew into [his] truck when [he] opened the doors." Mr. Roberts further explained that Jacobs would do sampling on rainy days when the ash [in] the air was not as bad."

During his deposition, Mr. Roberts testified that Tom Bock, a Jacobs Engineering Group, Inc. employee, told the workers at the Kingston site "every chance he could" that they "could eat

a pound of coal ash a day and . . . be okay." Mr. Roberts also testified that he did not wear a mask while working at the Kingston site because it was not allowed. He recalled other workers asking to wear a mask on the site, and "[t]hey got laid off." Specifically, Mr. Roberts recalled that another worker, Kevin Thompson, "asked for a dust mask, and then . . . wasn't there very much longer" before he was laid off.

After returning home each day from working at the Kingston site, Mr. Roberts "took off [his] dirty work clothes and showered right away." He recalled that when he showered, "the water was black from all the ash on [his] skin."

Based on the foregoing, it is my scientific opinion that Jimmy Roberts, more likely than not, was exposed by inhalation and ingestion to a long-term, continuous, and high intensity dose of coal fly ash during his employment at the Kingston site sufficient to result in numerous negative health effects as supported by the scientific literature.

**ADDENDUM 34: Individualized Exposure Assessment of James William "Bill" Rose**

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by James William "Bill" Rose at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; C. Ola Landgren, MD, PhD; and Raajit Rampal, MD, PhD.

**Materials Reviewed:**

With regard to Mr. Rose, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff Kaleb William Rose's Responses to Interrogatories;
- Personal Air Monitoring Data;
- August 10, 2020 Deposition of Kaleb William Rose; and
- August 4, 2020 Deposition of Donald Vangilder.

**Bill Rose's Work at the Kingston Coal Ash Recovery Site:**

It is estimated that Bill Rose worked on the site from June 2011 to September 2011. Bill Rose worked as a truck driver, which required him to work on and around the site during that period. In particular, Bill Rose drove a truck hauling coal ash, dirt, and other materials on and around the site.

**Sampling and Testing Relevant to Bill Rose's Work:**

Mr. Rose's work history indicates that he worked in the Dump Truck Operator SEG. The highest measured concentration in each year for this SEG are shown in the following table.

| SEG and year | Total Dust (μg/m$^3$) | Resp. PM (μg/m$^3$) | Silica (μg/m$^3$) |
|---|---|---|---|
| Dump Truck Operator | | | |
| 2009 | 360 | 260 | 13 |
| 2010 | | 95 | |
| 2011 | | 51 | |
| 2012 | | 36 | |

The sample results show that dump truck drivers such as Mr. Rose were consistently exposed to airborne RPM concentrations that were elevated, with the highest value about 25 times higher than the prevailing background $PM_{2.5}$ concentration, indicating a substantial exposure to airborne fly ash.

In addition to the air sampling described above, we can look to indirect evidence for his exposures.

**Evidence of Bill Rose's Exposure:**

Bill Rose died on August 22, 2015 and cannot describe his own exposure to the coal ash. However, another worker, Donald Vangilder, has explained that he regularly worked with Bill Rose on and around the site. Mr. Vangilder testified that both he and Bill Rose were both truck drivers who worked at the site during the same period.

Mr. Vangilder explained that, despite remaining in the cab of the truck, Bill Rose was still regularly exposed to coal ash on the site. Mr. Vangilder explained that dust from the coal ash was "everywhere" on the site, including in the exclusion zone and elsewhere on the site. Mr. Vangilder noted that Bill Rose "went everywhere" driving on the site. Mr. Vangilder explained that Bill Rose was "just driving [on the site] and just stirring up dust." When he saw Bill Rose, Mr. Vangilder

regularly noticed coal ash "on his face," "in his eyes," "in his nose," and "just all over his body." Mr. Vangilder recalled that coal ash "would even get on your sandwiches when you were eating your lunch on the site" and would be ingested.

Mr. Vangilder regularly observed coal ash on Bill Rose's body and in the cab of his truck. Mr. Vangilder explained that Bill Rose had to "always wip[e] the dust off the dash [of his truck]" so he could see the truck's gauges. Mr. Vangilder also explained that he and Bill Rose were "always carrying little rages" to "wip[e] our windshields off." Mr. Vangilder recalled Bill Rose asking for paper towels regularly to clean coal ash from within the truck's cab. Mr. Vangilder noted that the coal ash could accumulate in the truck's cab in "thick" layers. Mr. Vangilder further recalled that the coal ash would settle on the seats and, when patted, it would produce a "little cloud" of coal ash within the truck's cab. As he noted, Mr. Vangilder "personally observed this for Bill Rose."

Mr. Vangilder explained that Bill Rose was never able to "be away from the coal ash dust" while working. As he noted, the coal ash was "on all the trucks, so you're driving, it's just stirring up inside the cab and it's spinning around. There's just so much [of the coal ash]. It ain't going to go out [of the truck's cab]." Mr. Vangilder further explained that he could smell and taste the coal ash within the truck, would commonly "blow in [his] eyes" and he would be "constantly rubbing [his] eyes" because of the coal ash in the truck's cab. As Mr. Vangilder noted, he "personally observed" this type of environment in Bill Rose's truck.

When Bill Rose ended his work shift for the day, as Mr. Vangilder stated, Bill Rose would "tak[e] his shirts off, dusting everything off" so as not to get his personal vehicle dusty before going home for the day. However, as Mr. Vangilder testified, this did not work because the coal ash was too "fine" and was "just really dusty."

Based on the foregoing, it is my scientific opinion that Bill Rose, more likely than not, was exposed by inhalation and ingestion to a dose of coal fly ash during his employment at the Kingston site that was of sufficient intensity and duration so as to result in numerous negative health effects as supported by the scientific literature.

**ADDENDUM 35: Individualized Exposure Assessment of Mike Shelton**

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by Mike Shelton at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; Frances Arena, MD; and Sanjay Rajagopalan, MD.

**Materials Reviewed:**

With regard to Mr. Shelton, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff Angela Shelton's Responses to Interrogatories;
- Personal Air Monitoring Data;
- August 7, 2020 Deposition of Angela Shelton; and
- August 11, 2020 Deposition of Phillip Crick.

**Mike Shelton's Work at the Kingston Coal Ash Recovery Site:**

It is estimated that Mr. Shelton worked on the Kingston site from December 2008 to 2015. Mr. Shelton worked as a truck driver, driving an articulating dump truck, a fuel truck, or a water truck on and around the Kingston site during that period. Mr. Shelton also worked dredging materials. Mr. Shelton estimates that he regularly worked six to seven days a week for approximately twelve hours per day, or more due to overtime, during this period from 2009 to 2015.

**Sampling and Testing Relevant to Mike Shelton's Work:**

Based on his work history, sampling collected in the following SEGs is relevant to Mr. Shelton: Articulated Dump Truck Operator, Fuel Truck Operator, Water Truck Operator. Fuel truck operators were only monitored in 2011 and 2012. The highest measured concentrations in each SEG are summarized in the table below.

| SEG and year | Total Dust (μg/m$^3$) | Resp. PM (μg/m$^3$) | Silica (μg/m$^3$) |
|---|---|---|---|
| Artic Dump Truck Operator | | | |
| 2009 | 390 | 260 | 13 |
| 2010 | 350 | <42 | <8 |
| 2011 | | 200 | 17 |
| 2012 | | 120 | 13 |
| 2013 | | 62 | |
| 2014 | 200 | | |
| Fuel Truck Operator | | | |
| 2011 | | 320 | 24 |
| 2012 | | 38 | |
| Water Truck Operator | | | |
| 2009 | 170 | | |
| 2010 | 380 | 109 | |
| 2011 | | 320 | 24 |
| 2012 | | 150 | 10 |
| 2013 | | 280 | |
| 2014 | | 58 | |

These sample results indicate a repeated, substantial exposure to workers in Mr. Shelton's SEGs. The highest measured RPM concentration, 320 μg/m$^3$, measured for both his work as fuel truck and water truck driver, is approximately 30 times higher than the likely ambient background $PM_{2.5}$ concentration, indicating a substantial exposure to airborne fly ash. The highest measured exposure to silica, a human carcinogen, 24 μg/m$^3$, again measured for two of his jobs, is just slightly below the ACGIH TLV® of 25 μg/m$^3$. The fact that Mr. Shelton worked significant overtime makes his substantial exposures even more serious; if, for example, he worked 80 hours per week rather than 40 it would have doubled his total dose from inhalation and ingestion and

reduces the silica TLV® from 25 to 12.5 $\mu g/m^3$, and then 6 of the 7 silica measurements in the above table would have exceeded the TLV®.

In addition to the air sampling described above, we can look to indirect evidence for his exposures.

**Evidence of Mike Shelton's Exposure:**

Mr. Shelton died on August 2, 2015 and cannot describe his own exposure to coal ash. However, other workers, such as Phillip Crick, has explained that he worked with Mr. Shelton at the Kingston site. Mr. Crick testified about Mr. Shelton during his deposition. Mr. Crick stated that he worked with Mr. Shelton in the exclusion zone of the Kingston site. Mr. Crick testified that Mr. Shelton "was exposed to [coal ash] even more than [he] was . . . because he was there longer. Because he worked on the dredges and stuff like that when they were dredging that stuff out of the Emory River and all that. So . . . Mike [Shelton] had it a little bit worser than me."

Mr. Crick explained that he worked with Mr. Shelton "[a]bout every day," and that Mr. Shelton began working at the Kingston site before Mr. Crick. As Mr. Crick learned by speaking with Mr. Shelton that Mr. Shelton started working at the site "as soon as the coal spill happened" in December 2008 and that he was among "the first crews that went in there."

Mr. Crick stated that, in addition to driving various trucks on and around the Kingston site, Mr. Shelton worked on the dredging, doing "the most hazardous stuff" at the site. Mr. Shelton "worked in the slurry and the slime." Mr. Crick explained that Mr. Shelton also drove trucks on the site, including an articulating dump truck and a water truck. Mr. Crick noted that driving an articulating dump truck "was [Mr. Shelton's] primary job when Mr. Crick worked alongside him.

As an articulating dump truck driver, Mr. Shelton's work involved "getting out of the truck to perform inspections and various other tasks outside the vehicle." Mr. Crick explained that

sometimes Mr. Shelton would need to get out of the truck to repair it. Mr. Crick explained that he regularly saw coal ash on Mr. Shelton, stating that he would "[b]e just like the rest of us." Mr. Crick explained that the coal ash would get on Mr. Shelton and other workers, including on his face, mouth, nose, and arms. He stated that the coal ash "got everywhere," including on Mr. Shelton. Based upon his regular observations of Mr. Shelton, Mr. Crick estimated that Mr. Shelton got coal ash "everywhere [he] did," including in his "hair and everywhere else" because Mr. Shelton "was in the same environment."

Mr. Crick recalled seeing coal ash "caked" on the steps leading up to Mr. Shelton's articulating dump truck, and he estimated that "had to be getting in [Mr. Shelton's] truck" in the same way it was regularly getting into his truck. Mr. Crick explained that Mr. Shelton was in "the same condition, same atmosphere, same everything" as him, including being surround constantly by coal ash. In fact, Mr. Crick stated that "there was never a time" Mr. Shelton would have been in the exclusion zone and would "not [have been] covered in coal ash.

Mr. Crick stated that Mr. Shelton "absolutely" had "coal ash still on him" when he left the Kingston site at the end of the workday. Mr. Crick recalled his own experience that his boots "would get that [coal ash] all over it. And at the end of the day, it would just be like a slurry in that water [of the boot washing station]." Mr. Crick even stated that "[y]ou could clearly see [coal ash] on [Mr. Shelton's] boots and legs."

In responding to interrogatories, Mr. Shelton's wife, Angie Shelton, recalled that Mr. Shelton "had to wipe and blow his nose constantly." She stated that "[w]hen he blew his nose, a black mucus would come out." She further stated that "[h]e also coughed all the time" and would "spit up" a similar black mucus.

Ms. Shelton explained that Mr. Shelton would return home from working at the Kingston site with a "dust all over his face, arms, on his clothes, and . . . inside his boots." As she testified, when he came home from work, "he was dirty. He had . . . like a grayish-looking powder stuff on his clothes, on his face, in his hair, on the boots." She recalled that Mr. Shelton "would take his work clothes off right away" and put them in the washer. She explained that "[a]t first, he did not wash them right away. However, when he started to get sick, he washed his work clothes as soon as he could." She explained that "[h]is clothes were so covered in coal ash that they had to be washed constantly." In fact, she stated that his clothes were regularly so covered in coal ash, that it damaged the washing machine, requiring multiple repairs and eventual replacement. She further recalled that "[w]hen he came home and took off his coal ash covered boots, dust would fly out. Coal ash was all inside his boots." Ms. Shelton also described how Mr. Shelton's personal car was regularly covered in coal ash. As she stated, every time she washed his car, "the floorboard had gray-white-looking stuff in it, the gray-white stuff on the dash. And it – it was dirty."

Based on the foregoing, it is my scientific opinion that Mike Shelton, more likely than not, was exposed by inhalation and ingestion to a long-term, continuous, and high intensity dose of coal fly ash during his employment at the Kingston site sufficient to result in numerous negative health effects as supported by the scientific literature.

**ADDENDUM 36: Individualized Exposure Assessment of Kenneth Shepherd**

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by Kenneth Shepherd at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; and Carrie A Redlich, MD, MPH.

**Materials Reviewed:**

With regard to Mr. Shepherd, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff Kenneth Shepherd's Responses to Interrogatories;
- Personal Air Monitoring Data; and
- September 27, 2017 Deposition of Kenneth Shepherd.

**Kenneth Shepherd's Work at the Kingston Coal Ash Recovery Site:**

Mr. Shepherd estimates that worked on the Kingston site beginning December 23, 2008 for approximately 3 years. Mr. Shepherd worked as an equipment operator, driving various heavy equipment on and around the Kingston site, including a track hoe, a bulldozer, a grease truck, and a crane. He also worked on the water at the site, operating a dredge boat and the track hoe situated on the dredge boat. Mr. Shepherd explained that he "would do whatever they needed [him] to do" at the Kingston site. Mr. Shepherd stated that "[t]here wasn't an inch of the [Kingston] site that [he] wasn't on." Mr. Shepherd estimates that he worked five to six days a week for approximately ten hours per day, or more due to overtime, during this period from December 23, 2008 to 2011.

**Sampling and Testing Relevant to Kenneth Shepherd's Work:**

Mr. Shepherd worked at many different jobs on the site, so that all of the following SEGs are relevant to his potential exposures: Excavator Operator, Dozer Operator, Crane Operator, Dredge Boat Operator. Only two crane operators and three dredge boat operators were monitored throughout the entire site monitoring period. The highest measured concentrations in each SEG are summarized in the table below.

| SEG and year | Total Dust ($\mu g/m^3$) | Resp. PM ($\mu g/m^3$) | Silica ($\mu g/m^3$) |
|---|---|---|---|
| Excavator Operator | | | |
| 2009 | 210 | 69 | |
| 2010 | 1400 | | |
| 2011 | | 690 | 18 |
| 2012 | | 520 | |
| 2013 | | 1100 | 7 |
| 2014 | 240 | | |
| Dozer Operator | | | |
| 2009 | 1300 | 210 | 18 |
| 2010 | 930 | 58 | |
| 2011 | | 200 | 26 |
| 2012 | | 77 | |
| 2013 | | 61 | |
| Crane Operator | | | |
| 2011 | | 45 | |
| Dredge Boat Operator | | | |
| 2009 | | 100 | |
| 2010 | | <41 | |

These measurements indicate very high exposures to these SEGs. The TPM measurements represent very high exposures to total particle mass, and the RPM measurements for the Excavators in 2011-2013 are very high, approximately 50 – 100 times higher than the prevailing background $PM_{2.5}$ concentration, indicating a substantial exposure to airborne fly ash. Given the very limited sampling that was performed, the measured RPM exposures for Crane Operator and Dredge Boat Operator likely are far below the maximum exposures ever experienced by workers in those SEGs.

The highest measured concentration for silica, a human carcinogen, exceeds the ACGIH TLV® of 25 µg/m³. The measurements indicate that Mr. Shepherd received substantial exposures across all of his SEGs.

In addition to the air sampling described above, we can look to indirect evidence for his exposures.

**Evidence of Kenneth Shepherd's Exposure:**

Mr. Shepherd has described his exposure to coal ash while working at the Kingston site. For example, in responding to interrogatories, he explained that he worked all over the Kingston site and that he "was in the ash all the time and it would cover me." He further stated that he "could taste the ash in the air." He recalled that "[t]hey put lime in [the coal ash] to dry it out." As a result, he recalled that the ash would regularly cover his body, his clothes, and his car.

Mr. Shepherd testified during his deposition that he regularly handled fly ash, particularly when working on the dredge boat. As he explained, "when the equipment would jam you'd have to touch the water and the fly ash that was in the water." He further explained that he would attempt to wash the coal ash off his hands in the river, but he noted that "[i]f you got [coal ash] on your clothes . . . it would dry on your clothes" and remain there. Mr. Shepherd stated that even if a worker cleaned himself, he would then have to go "right back through the wash and stuff and walked right back through that [coal ash] and carried it right back into [his] equipment."

Mr. Shepherd explained that he became concerned that the coal ash was unsafe, but he recalled that the workers were told that "there was nothing in it that would hurt us." In particular, Mr. Shepherd recalled that a Jacobs Engineering Group, Inc. employee told them that they "could eat" the coal ash without it negatively affecting them.

Mr. Shepherd stated that when he returned home from working at the Kingston site, he would "take [his] clothes off outside when [he] got home" and would immediately get in the shower. He recalled that when he showered "the water would look grey." He recalled that his washing machine had to be replaced twice, because his clothes were regularly covered in coal ash when washed.

Based on the foregoing, it is my scientific opinion that Kenneth Shepherd, more likely than not, was exposed by inhalation and ingestion to a long-term, continuous, and high intensity dose of coal fly ash during his employment at the Kingston site sufficient to result in numerous negative health effects as supported by the scientific literature.

**ADDENDUM 37: Individualized Exposure Assessment of Shaun Smith**

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by Shaun Travis Smith at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; and Theron Blickenstaff, MD.

**Materials Reviewed:**

With regard to Mr. Smith, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff Shaun Smith's Responses to Interrogatories;
- Personal Air Monitoring Data; and
- September 15, 2017 Deposition of Shaun Travis Smith.

**Shaun Smith's Work at the Kingston Coal Ash Recovery Site:**

Mr. Smith estimates he worked on the Kingston site from December 2008, shortly after the coal ash spill occurred, to May 2013. Mr. Smith worked as a truck driver, driving a water truck and hauling heavy equipment on and around the Kingston site during that period. Mr. Smith estimates that he regularly worked up to seven days a week for approximately ten hours per day, or more due to overtime, during this period from December 2008 to May 2013.

**Sampling and Testing Relevant to Shaun Travis Smith's Work:**

Based on his work history, sampling collected in the following SEGs is relevant to Mr. Smith: Articulated Dump Truck Operator, Dump Truck Operator, Water Truck Operator. The highest measured concentrations in each SEG are summarized in the table below.

| SEG and year | Total Dust ($\mu g/m^3$) | Resp. PM ($\mu g/m^3$) | Silica ($\mu g/m^3$) |
|---|---|---|---|
| Artic Dump Truck Operator | | | |
| 2009 | 390 | 260 | 13 |
| 2010 | 350 | <42 | <8 |
| 2011 | | 200 | 17 |
| 2012 | | 120 | 13 |
| 2013 | | 62 | |
| 2014 | 200 | | |
| Dump Truck Operator | | | |
| 2009 | 360 | 260 | 13 |
| 2010 | | 95 | |
| 2011 | | 51 | |
| 2012 | | 36 | |
| Water Truck Operator | | | |
| 2009 | 170 | | |
| 2010 | 380 | 109 | |
| 2011 | | 320 | 24 |
| 2012 | | 150 | 10 |
| 2013 | | 280 | |
| 2014 | | 58 | |

These sample results indicate a repeated, substantial exposure to workers in Mr. Smith's SEGs. The highest measured RPM concentration, 320 $\mu g/m^3$, is approximately thirty times higher than the likely ambient background $PM_{2.5}$ concentration, indicating a substantial exposure to airborne fly ash. The highest measured exposure to silica, a human carcinogen, 24 $\mu g/m^3$, is just slightly less than the ACGIH TLV® of 25 $\mu g/m^3$. The fact that Mr. Billingsley worked significant overtime makes his substantial exposures even more serious; if, for example, he worked 80 hours per week rather than 40 it would have doubled his total dose from inhalation and ingestion and

reduces the silica TLV® from 25 to 12.5 µg/m$^3$, and then 5 of the 7 silica measurements in the above table would have exceeded the TLV®.

In addition to the air sampling described above, we can look to indirect evidence for his exposures.

**Evidence of Shaun Travis Smith's Exposure:**

Mr. Smith has described his exposure to coal ash while working at the Kingston site. For example, in responding to interrogatories, he explained that "[w]hen [he] would first arrive on the site, [he] could see the dust in the air." He noted that he would get to the site earlier than other workers to "wet down" the coal ash. He explained that he would do what he could to wet down the coal ash, "but there would still be ash in the air even after wetting it down." As he testified, "everything was gray[]" on the Kingston site because there "was ash everywhere." Mr. Smith recalled that "[t]he ash would be all over [his] clothes." He further explained that he "could taste the ash in [his] mouth and feel the grit in [his] teeth."

During his deposition, Mr. Smith testified that several people, including Tom Bock and Chris Eich, both Jacobs Engineering Group, Inc. employees, told him that coal ash was safe to be around. Mr. Smith explained that he did not wear a mask while working on the Kingston site.

Mr. Smith testified that coal ash regularly got into the cab of his truck. He explained that the truck's air filters "never got cleaned," despite his requests. He further recalled an occasion where he was told to leave the cab open "because the systems in them were so nasty if you turned the air on just crap would start blowing everywhere[]" and "ash and everything would start blowing out of them everywhere because the filters [] were so nasty in them. They actually had [the workers] run them with the cabs open."

Mr. Smith noted that he would try to clean the coal ash off his body and clothing before leaving the Kingston site after working, but that he "could not get it all off." He recalled getting in his car and taking the coal ash home with him, because it was covering his body, clothes, and belongings. He explained that when he would shower after returning home, "the water would be black sometimes." Further, he recalled that his washing machine broke from washing his clothes that were covered in coal ash.

Based on the foregoing, it is my scientific opinion that Shaun Smith, more likely than not, was exposed by inhalation and ingestion to a long-term, continuous, and high intensity dose of coal fly ash during his employment at the Kingston site sufficient to result in numerous negative health effects as supported by the scientific literature.

**ADDENDUM 38: Individualized Exposure Assessment of Brian Summers**

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by Brian Summers at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; and Theron Blickenstaff, MD.

**Materials Reviewed:**

With regard to Brian Summers, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff Brian Summers' Responses to Interrogatories;
- Employment Records for Brian Summers;
- Personal Air Monitoring Data; and
- August 7, 2017 Deposition of Brian Summers.

**Brian Summers' Work at the Kingston Coal Ash Recovery Site:**

Union records indicate that Mr. Summers was employed by Mactec Development Corp. in May 2009 to August 2009; and by GUBMK from November 2009 to December 2013. Mr. Summers estimates he worked on the Kingston site from May 2009 to December 2013. Mr. Summers worked inside the exclusion zone on the Kingston site as a truck driver, driving a water truck, pickup trucks, and a "low boy" on and around the Kingston site during that period. Mr. Summers estimates that he regularly worked up to seven days a week for approximately ten hours per day, or more due to overtime, during this period from May 2009 to December 2013.

**Sampling and Testing Relevant to Brian Summers' Work:**

Based on his work history, sampling collected in the following SEGs is relevant to Mr. Summers: Dump Truck Operator, Water Truck Operator. The highest measured concentrations in each SEG are summarized in the table below.

| SEG and year | Total Dust (μg/m$^3$) | Resp. PM (μg/m$^3$) | Silica (μg/m$^3$) |
|---|---|---|---|
| Dump Truck Operator | | | |
| 2009 | 360 | 260 | 13 |
| 2010 | | 95 | |
| 2011 | | 51 | |
| 2012 | | 36 | |
| Water Truck Operator | | | |
| 2009 | 170 | | |
| 2010 | 380 | 109 | |
| 2011 | | 320 | 24 |
| 2012 | | 150 | 10 |
| 2013 | | 280 | |
| 2014 | | 58 | |

These sample results indicate a repeated, substantial exposure to workers in Mr. Summer's SEGs. The highest measured RPM concentration, 320 μg/m$^3$, is approximately 30 times higher than the likely ambient background $PM_{2.5}$ concentration, indicating a substantial exposure to airborne fly ash. The highest measured exposure to silica, a human carcinogen, 24 μg/m$^3$, is just slightly less than the ACGIH TLV® of 25 μg/m$^3$. The fact that Mr. Summers worked significant overtime makes his substantial exposures even more serious; if, for example, he worked 80 hours per week rather than 40 it would have doubled his total dose from inhalation and ingestion and reduces the silica TLV® from 25 to 12.5 μg/m$^3$, and then 5 of the 7 silica measurements in the above table would have exceeded the TLV®.

In addition to the air sampling described above, we can look to indirect evidence for his exposures.

**Evidence of Brian Summers' Exposure:**

Brian Summers has described his exposure to coal ash while working at the Kingston site. For example, in responding to interrogatories, he explained that "everything was always covered in coal ash" at the Kingston site. He stated, "[The coal ash] got all over everyone and the equipment. It covered the buildings too. The ash floated around in the air and was so thick that I could see it." He explained that "[w]hen the wind blew, the ash flew up into the air even more." He described the ash as being "like sand at the beach but thinner" and as being "very fine" and "dr[ying] out rapidly."

Mr. Summers recalled that the coal ash was "hard to control and keep wet." He explained that, as a water truck driver, he was tasked with preventing the coal ash "from drying out and getting into the air." However, he explained that "it was impossible" to prevent the coal ash from getting into the air. He stated that even with "20 something water trucks running [around the Kingston site] at once[, they] could still not keep the ash from drying out."

Mr. Summers explained that the coal ash "got all over [him] at Kingston." He stated, "It covered [his] clothes, shoes, and even got on [his] skin and in [his] hair" and "got in [his] nose, ears, eyes, and mouth . . . [and] all over [his] skin too." He recalled trying to clean his boots in the boot washing stations, "but they were not effective" because "[a]fter just a couple of workers used them, the water was nasty and was not good for cleaning anything."

Mr. Summers stated, "The outside and inside of the trucks that [he] drove were filled with ash. The ash got all on the floorboards from [his] boots but also all over everything else in the cab because it floated in and settled all over. It was on the steering wheel, seats, dashboard, and windshield. [He] had to wipe [the coal ash] off constantly. However, it got dirty again quickly."

At the end of his shift, Mr. Summers "still had coal ash all over [his] clothes and boots. He recalled that he would track the coal ash into his car and his home. He described how the coal ash had gotten all over his personal car because "it fell off of [him] every day."

In his deposition, Mr. Summers testified that Tom Bock, a Jacobs Engineering Group, Inc. employee, said that fly ash "wouldn't hurt you" and "you could eat a pound of it." Mr. Summers recalled that, in 2012 and 2013, he requested a mask to wear while working on the Kingston site, but Mr. Bock "told [the workers] that [the coal ash] would not hurt [them]" and "[t]hat [the workers] didn't need a mask." Eventually, Mr. Summers wore a mask on the site "probably around August [2013]," but it was not provided to him or the other workers. He recalled that he was forced to purchase the mask himself.

Based on the foregoing, it is my scientific opinion that Brian Summers, more likely than not, was exposed by inhalation and ingestion to a long-term, continuous, and high intensity dose of coal fly ash during his employment at the Kingston site sufficient to result in numerous negative health effects as supported by the scientific literature.

**ADDENDUM 39: Individualized Exposure Assessment of Robert Tedder**

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by Robert Tedder at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; and Theron Blickenstaff, MD.

**Materials Reviewed:**

With regard to Robert Tedder, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff Tedder's Responses to Interrogatories;
- Employment Records for Robert Tedder;
- Personal Air Monitoring Data; and
- September 29, 2017 Deposition of Robert Tedder.

**Robert Tedder's Work at the Kingston Coal Ash Recovery Site:**

Union records indicate that Robert Tedder was employed by Mactec, Inc. from November 5, 2009 to February 3, 2010; by Sevenson Environmental Services, Inc. from February 3, 2010 to July 1, 2010; and by GUBMK from August 4, 2010 to August 9, 2013. Mr. Tedder estimates he worked on the Kingston site from November 2009 to August 2013. Mr. Tedder worked as a heavy equipment operator, operating a bulldozer, a track hoe, and a compactor on the Kingston site during that period. He explained that he regularly worked inside the exclusion zone on the site. Mr.

Tedder estimates that he regularly worked up to seven days a week for approximately ten hours per day, or more due to overtime, during this period from November 2009 to August 2013.

**Sampling and Testing Relevant to Robert Tedder's Work**:

Based on his work history, air sampling done for the SEGs Excavator Operator and Dozer Operator are relevant to Mr. Tedder's work at the Kingston site. The highest measured concentrations in each SEG are summarized in the table below.

| SEG and year | Total Dust (μg/m$^3$) | Resp. PM (μg/m$^3$) | Silica (μg/m$^3$) |
|---|---|---|---|
| Excavator Operator | | | |
| 2009 | 210 | 69 | |
| 2010 | 1400 | | |
| 2011 | | 690 | 18 |
| 2012 | | 520 | |
| 2013 | | 1100 | 7 |
| Dozer Operator | | | |
| 2009 | 1300 | 210 | 18 |
| 2010 | 930 | 58 | |
| 2011 | | 200 | 26 |
| 2012 | | 77 | |
| 2013 | | 61 | |

These measurements indicate very high exposures to these SEGs. The TPM measurements represent very high exposures to total particle mass, and the RPM measurements for the Excavators in 2011-2013 are very high, approximately 50 – 100 times higher than the prevailing background $PM_{2.5}$ concentration, indicating a substantial exposure to airborne fly ash. The highest measured concentration for silica, a human carcinogen, exceeds the ACGIH TLV® of 25 μg/m$^3$. The fact that Mr. Tedder worked significant overtime makes his substantial exposures even more serious; if, for example, he worked 80 hours per week rather than 40 it would have doubled his total dose from inhalation and ingestion and reduces the silica TLV® from 25 to 12.5 μg/m$^3$, and then 3 of the 4 silica measurements in the above table would have exceeded the TLV®.

In addition to the air sampling described above, we can look to indirect evidence for his exposures.

**Evidence of Robert Tedder's Exposure:**

Mr. Tedder has described his exposure to coal ash while working at the Kingston site. For example, in responding to interrogatories, he stated that "the site was always covered in fly ash," which is also called coal ash. He explained that the coal ash "was impossible to escape" and "was in the air and settled all over the equipment and workers." He recalled, "Even though the water trucks ran all the time trying to keep the ash wet, it was always kicking up everywhere."

Mr. Tedder stated that "[t]he ash got all over [him] and [his] belongings. It got on [his] exposed skin on [his] face, arms, and neck." He noted that the coal ash "was also in [his] hair and even in [his] mouth, ears, and nose. He described being able to "taste the gritty ash in [his] mouth." He recalled that "[his] clothes and boots also always had ash all over them." When he would blow his nose, he stated that a "dark grey mucus came out." Mr. Tedder recalled eating lunch in areas that "had coal ash all over the floor" and "[t]he ash from [his] hands got on [his] food and drinks."

Mr. Tedder explained that in his heavy machinery "[t]he seat, wheel, dashboard, and windshield were covered in the dry ash from the air." He noted that "[t]he dusty ash came in through the open doors and windows but also through the air vents." He further stated that "[a]t the end of the day, the ash was still all over [him] and [his] clothes. [He] tracked it into [his] personal car and in [his] home."

Despite coal ash "always cover[ing]" the Kingston site, Mr. Tedder stated that masks were not allowed to be worn on the site. As he stated, "Jacobs told [the workers they] could not wear masks and if [they] wanted one, [they] should go home." Specifically, he recalled that Tom Bock,

a Jacobs Engineering Group, Inc. employee, told workers that they were "not going to have respirators." As a result, Mr. Tedder did not wear a mask while working at the Kingston site.

Based on the foregoing, it is my scientific opinion that Robert Tedder, more likely than not, was exposed by inhalation and ingestion to a long-term, continuous, and high intensity dose of coal fly ash during his employment at the Kingston site sufficient to result in numerous negative health effects as supported by the scientific literature.

**ADDENDUM 40: Individualized Exposure Assessment of App Brian Thacker**

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by App Brian Thacker at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; and Carrie A Redlich, MD, MPH.

**Materials Reviewed:**

With regard to Mr. Thacker, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff Brian Thacker's Responses to Interrogatories;
- Employment Records for Brian Thacker;
- Personal Air Monitoring Data;
- April 10, 2017 Deposition of Billy Gibson;
- October 6, 2020 Deposition of Angela Thacker; and
- August 14, 2017 Deposition of Brian Thacker.

**Brian Thacker's Work at the Kingston Coal Ash Recovery Site:**

Union records indicate that Mr. Thacker was employed by Trans-Ash from April 7, 2009 to August 7, 2009, by Sevenson Environmental Services, Inc. from August 10, 2009 to July 12, 2010, by GUBMK from July 23, 2010 to September 27, 2013. Mr. Thacker worked as a heavy equipment operator, operating a bulldozer, amphibious excavator and track hoe inside the exclusion zone on the Kingston site during this period. Mr. Thacker also operated a dredge on the

Kingston site. Mr. Thacker estimates he worked up to seven days a week for approximately twelve hours per day, or more due to overtime, during this period from April 2009 to September 2013.

**Sampling and Testing Relevant to Brian Thacker's Work:**

Based on his work history, air sampling done for the SEGs Amphibious Excavator Operator, Excavator Operator, Dozer Operator and Dredge Boat Operator are relevant to Mr. Thacker's work at the Kinston site. The highest measured concentrations in each SEG are summarized in the table below.

| SEG and year | Total Dust (μg/m$^3$) | Resp. PM (μg/m$^3$) | Silica (μg/m$^3$) |
|---|---|---|---|
| Amphibious Excavator Oper | | | |
| 2009 | 1200 | 550 | 41 |
| 2010 | 270 | 110 | 21 |
| 2011 | | 240 | 11 |
| 2012 | | 44 | |
| Excavator Operator | | | |
| 2009 | 210 | 69 | |
| 2010 | 1400 | | |
| 2011 | | 690 | 18 |
| 2012 | | 520 | |
| 2013 | | 1100 | 7 |
| 2014 | 240 | | |
| Dozer Operator | | | |
| 2009 | 1300 | 210 | 18 |
| 2010 | 930 | 58 | |
| 2011 | | 200 | 26 |
| 2012 | | 77 | |
| 2013 | | 61 | |
| Dredge Boat Operator | | | |
| 2009 | | 100 | |
| 2010 | | <41 | |

These measurements indicate very high exposures to these SEGs. The TPM measurements represent very high exposures to total particle mass, and the RPM measurements for the Excavators in 2011-2013 are very high, approximately 50 – 100 times higher than the prevailing background $PM_{2.5}$ concentration, indicating a substantial exposure to airborne fly ash. The two highest

measured concentration for silica, a human carcinogen, exceed the ACGIH TLV® of 25 μg/m$^3$. The fact that Mr. Thacker worked significant overtime makes his substantial exposures even more serious; if, for example, he worked 80 hours per week rather than 40 it would have doubled his total dose from inhalation and ingestion and reduces the silica TLV® from 25 to 12.5 μg/m$^3$, and then 5 of the 7 silica measurements in the above table would have exceeded the TLV®.

In addition to the air sampling described above, we can look to indirect evidence for his exposures.

**Evidence of Brian Thacker's Exposure:**

Mr. Thacker has described his exposure to coal ash while working at the Kingston site. For example, in responding to interrogatories, he stated that "[t]he ash got all over [him] while [he] worked at Kingston. He recalled that "[t]he dusty ash covered [his] clothes, boots, and skin [and] stuck to [him] really bad when [he] was sweating." He explained that the coal ash "collected on any exposed skin including [his] face," and that he "could feel it in [his] nose, ears, eyes, and mouth" and "could taste it." Mr. Thacker explained that following work at the Kingston site each day, "the ash was all over [him]." He explained that he tracked coal ash into his car, such that "the inside of [his] car always had ash in it." He further explained that he "carried [the coal ash] with [him] on [his] clothes everywhere when [he] left the site."

Mr. Thacker explained that "[t]he ash covered [his] equipment," covering the outside and the inside of the cab. He stated, "The ash got into the cab through the window and vents because it was so thick in the air, but so much ash fell off my boots and clothes that there was a film of ash in the cab. It was on the floor, seats, dashboard, and windshield." Mr. Thacker testified that Tom Bock, a Jacobs Engineering Group, Inc. employee, told him on several occasions that coal ash "wouldn't hurt [the workers]" and that "[y]ou could eat it."

Mr. Thacker stated that the workers on the Kingston site were not given any equipment to "actually protect[] [them] from the coal ash." He testified that he asked Mr. Bock for a mask, to which Mr. Bock responded that "[y]ou're not allowed to wear a mask out here [on the Kingston site]. Period." Eventually, Mr. Thacker underwent testing along with another worker, Billy Gibson, which determined that they "could have a mask" while working at the Kingston site. In his deposition, Mr. Gibson likewise testified that he went with Mr. Thacker for "an evaluation and test to see if they could wear a respirator [and be] given the clearance to do so and wear it on the site." Mr. Thacker testified that when he provided these results to Tom Bock, Mr. Bock "[s]till refused" to allow him to wear a mask. Nevertheless, for his health and for his protection, Mr. Thacker started to wear his own mask from home and "was let go within the week."

Mr. Thacker's wife, Angela Thacker, testified in her deposition that when he returned home from working at the Kingston site she would regularly notice that his "truck [was] like completely covered." She estimated that the truck was covered in a "three, sometimes four inches" thick film of coal ash, which could fall off with the vibrations of the truck. She recalled that Mr. Thacker would be "completely covered" in "inches" of coal ash when he exited his truck. As she described it, the coal ash was "literally hanging like you threw mud at him." She explained that she would normally "dust [the coal ash] all off" from his clothes onto the floor, "shake [his clothes] out," "brush them off" and then place them in the laundry. She stated that she had to sweep up coal ash from in and around their home on a weekly basis. She recalled her own exposure to the coal ash: "I was in contact with all this [coal ash], not only my skin, but breathing it in, me and [Mr. Thacker] both would blow our nose afterward to get all the stuff out of our nose, and you're blowing black."

Based on the foregoing, it is my scientific opinion that Brian Thacker, more likely than not, was exposed by inhalation and ingestion to a long-term, continuous, and high intensity dose of

coal fly ash during his employment at the Kingston site sufficient to result in numerous negative health effects as supported by the scientific literature.

**ADDENDUM 41: Individualized Exposure Assessment of Kevin Thompson**

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by Kevin Thompson at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; and Carrie A Redlich, MD, MPH.

**Materials Reviewed:**

With regard to Mr. Thompson, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff Kevin Thompson's Responses to Interrogatories;
- Employment Records for Kevin Thompson;
- Personal Air Monitoring Data;
- January 25, 2017 Deposition of Dustin Berry;
- August 11, 2017 Deposition of Gabriel Billingsley;
- August 4, 2020 Deposition of David Johnson;
- August 13, 2020 Deposition of Jimmy Roberts;
- October 19, 2020 Deposition of Nicholas Perry; and
- September 6, 2017 Deposition of Kevin Thompson.

**Kevin Thompson's Work at the Kingston Coal Ash Recovery Site:**

Union records indicate that Mr. Thompson was employed by Astrid Contract Tech Serv Inc. throughout 2009, and by GUBMK from February 2010 to June 2013. Mr. Thompson estimates

he worked on the Kingston site from February 2009 to June 2013. Mr. Thompson worked as a truck driver, driving a water truck, fuel truck, and articulated dump on and around the Kingston site during that period. Mr. Thompson estimates he worked six to seven days a week for approximately ten hours per day, or more due to overtime, during this period from February 2009 to June 2013.

**Sampling and Testing Relevant to Kevin Thompson's Work:**

Based on his work history, sampling collected in the following SEGs is relevant to Mr. Thompson: Articulated Dump Truck Operator, Fuel Truck Operator, Water Truck Operator. Fuel truck operators were only monitored in 2011 and 2012. The highest measured concentrations in each SEG are summarized in the table below.

| SEG and year | Total Dust (μg/m$^3$) | Resp. PM (μg/m$^3$) | Silica (μg/m$^3$) |
|---|---|---|---|
| Artic Dump Truck Operator | | | |
| 2009 | 390 | 260 | 13 |
| 2010 | 350 | <42 | <8 |
| 2011 | | 200 | 17 |
| 2012 | | 120 | 13 |
| 2013 | | 62 | |
| 2014 | 200 | | |
| Fuel Truck Operator | | | |
| 2011 | | 320 | 24 |
| 2012 | | 38 | |
| Water Truck Operator | | | |
| 2009 | 170 | | |
| 2010 | 380 | 109 | |
| 2011 | | 320 | 24 |
| 2012 | | 150 | 10 |
| 2013 | | 280 | |
| 2014 | | 58 | |

These sample results indicate a repeated, substantial exposure to workers in Mr. Thompson's SEGs. The highest measured RPM concentration, 320 μg/m$^3$, measured for both his work as fuel truck and water truck driver, is approximately thirty times higher than the likely

ambient background $PM_{2.5}$ concentration, indicating a substantial exposure to airborne fly ash. The highest measured exposure to silica, a human carcinogen, 24 $\mu g/m^3$, again measured for two of his jobs, is just slightly below the ACGIH TLV® of 25 $\mu g/m^3$. The fact that Mr. Thompson worked significant overtime makes his substantial exposures even more serious; if, for example, he worked 80 hours per week rather than 40 it would have doubled his total dose from inhalation and ingestion and reduces the silica TLV® from 25 to 12.5 $\mu g/m^3$, and then 6 of the 7 silica measurements in the above table would have exceeded the TLV®.

In addition to the air sampling described above, we can look to indirect evidence for his exposures.

**Evidence of Kevin Thompson's Exposure:**

Mr. Thompson has described his exposure to coal ash while working at the Kingston site. For example, in responding to interrogatories, he described the coal ash being "in the air" and being "like a powder." He stated, "I could see [coal ash] particles in the air floating around . . . [i]t was so thick that when I was driving the water truck, I could not see in front of me. I had to stop and wait and spray as much water as I could to be able to see where I was going." He explained that the coal ash "got all over [his] boots and [his] truck" and that "[so] much ash got in the cab that the floors were covered in ash 4 to 5 inches deep." As he explained, Mr. Thompson sat in the cab of his truck "all day," surrounded by the coal ash.

Mr. Thompson recalled that boot washing stations were provided, but they were "not effective because they got dirty so quickly." He explained that the boot washes "filled up with dirty water as each worker tried to clean their boots off," such that "[b]y the time most of [the workers] got to [the] pan, the water was too dirty to use to wash our boots." As he described it, the water in the boot wash was like "pudding" because it was filled with coal ash.

Mr. Thompson explained that the coal ash "got all over [his] clothes and body." He recalled that he "could feel [the coal ash] on [his] exposed skin and in [his] hair [and] all on [his] hands and arms so bad that they were black." He complained of coal ash "even in [his] nose and mouth," explaining that he was "constantly breathing it in and even eating it when it got on [his] food and in [his] mouth throughout the day." He further recalled that the coal ash "got in [his] eyes too and made them red and itchy." He stated, "No matter where [he] ate, the ash got on [his] food. The ash was even inside the coolers where [the workers] got [their] water bottles from . . . [He] could taste the ash in [his] water bottle." Mr. Thompson further explained that the coal ash "got in [his] personal car and on [his] work clothes, which [he] wore into [his] home." When he returned home after working at the Kingston site each day, Mr. Thompson recalled that "[he] did not have any reason to separate [his clothes] because they told us that the ash was safe." Thus, his clothes, which were covered in coal ash, were mixed in with his family's clothes.

During his deposition, Mr. Thompson testified that workers at the Kingston site could be fired for wearing masks or respirators. Mr. Thompson explained that "they didn't want dust masks in the public eye." He testified that he was present when Tom Bock, a Jacobs Engineering Group, Inc. employee, instructed other Jacobs employees to "come to [the] tool room, t[ake] every brand new dust mask that the government – the taxpayers had bought and got them and thr[ew] them in the trash. Wouldn't let [the workers] have [the masks]. . . . And if you didn't like it, they'd find somebody else to do the job." On another occasion, Mr. Thompson recalled hearing Chris Eich, another Jacobs Engineering Group, Inc. employee, state "you'd be hung – you'd hang yourself if you – if you wore a dust mask." In short, Mr. Thompson described how the workers on the Kingston were denied the opportunity to wear a mask while working in and around the coal ash.

Mr. Thompson recalled that Tom Bock told him several times that "[he] could eat a pound of [coal ash] and it wouldn't harm [him]." He further recalled that Mr. Bock said on one occasion that "it has been proven that [coal ash] can't hurt you" and "that they never got a[n] abnormal reading on an air monitor test."

Multiple other workers at the Kingston site testified during depositions that Mr. Thompson was fired for requesting to wear a mask at the site, including Dustin Berry, David Johnson, Gabriel Billingsley, Jimmy Roberts, and Nicholas Perry. Mr. Berry testified in his deposition that Mr. Thompson was fired for requesting a mask. Mr. Berry explained that Mr. Thompson was "laid . . . off over [asking for a dust mask]" to wear on the site. Mr. Johnson likewise testified that "they finally got rid of [Mr. Thompson] because he was told to wear a mask" on the site. He explained that "they wouldn't let [Mr. Thompson] work . . . and wear a mask." Mr. Billingsley recalled that Mr. Thompson was fired for bringing awareness to safety and health issue relating to the coal ash. Mr. Billingsley testified during his deposition that Mr. Thompson was fired because he was "speaking up about his health issues." Mr. Roberts testified that Mr. Thompson requested a mask and "wasn't there very much longer" before he was laid off. And Mr. Perry testified that he believed Mr. Thompson had been fired for wearing a mask at the site.

Based on the foregoing, it is my scientific opinion that Kevin Thompson, more likely than not, was exposed by inhalation and ingestion to a long-term, continuous, and high intensity dose of coal fly ash during his employment at the Kingston site sufficient to result in numerous negative health effects as supported by the scientific literature.

**ADDENDUM 42: Individualized Exposure Assessment of Jeff Townsley**

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by Jeff Townsley at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; and Theron Blickenstaff, MD.

**Materials Reviewed:**

With regard to Mr. Townsley, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff Jeff Townsley's Responses to Interrogatories;
- Employment Records for Jeff Townsley;
- Personal Air Monitoring Data; and
- August 5, 2020 Deposition of Jeff Townsley.

**Jeff Townsley's Work at the Kingston Coal Ash Recovery Site:**

Union records indicate that Jeff Townsley was employed by GUBMK from June 2010 to December 2011. Mr. Townsley estimates that he worked on the Kingston site from June 2010 to December 1, 2011. Mr. Townsley worked as a truck driver, hauling coal ash on and around the Kingston site during that period. Mr. Townsley also drove a water truck on and around the Kingston site during that period. Mr. Townsley estimates that he regularly worked up to seven days a week for approximately sixty hours per week, or more due to overtime, during this period from June 2010 to December 2011.

**Sampling and Testing Relevant to Jeff Townsley's Work:**

Based on his work history, sampling collected in the following SEGs is relevant to Mr. Townsley: Dump Truck Operator, Water Truck Operator. The highest measured concentrations in each SEG are summarized in the table below.

| SEG and year | Total Dust (µg/m$^3$) | Resp. PM (µg/m$^3$) | Silica (µg/m$^3$) |
|---|---|---|---|
| Dump Truck Operator | | | |
| 2009 | 360 | 260 | 13 |
| 2010 | | 95 | |
| 2011 | | 51 | |
| 2012 | | 36 | |
| Water Truck Operator | | | |
| 2009 | 170 | | |
| 2010 | 380 | 109 | |
| 2011 | | 320 | 24 |
| 2012 | | 150 | 10 |
| 2013 | | 280 | |
| 2014 | | 58 | |

These sample results indicate a repeated, substantial exposure to workers in Mr. Townsley's SEGs. The highest measured RPM concentration, 320 µg/m$^3$, is approximately 30 times higher than the likely ambient background $PM_{2.5}$ concentration, indicating a substantial exposure to airborne fly ash. The highest measured exposure to silica, a human carcinogen, 24 µg/m$^3$, is just slightly less than the ACGIH TLV® of 25 µg/m$^3$. The fact that Mr. Townsley worked significant overtime makes his substantial exposures even more serious; if, for example, he worked 80 hours per week rather than 40 it would have doubled his total dose from inhalation and ingestion and reduces the silica TLV® from 25 to 12.5 µg/m$^3$, and then 5 of the 7 silica measurements in the above table would have exceeded the TLV®.

In addition to the air sampling described above, we can look to indirect evidence for his exposures.

**Evidence of Jeff Townsley's Exposure:**

Mr. Townsley has described his exposure to coal ash while working at the Kingston site. For example, in responding to interrogatories, he explained that he "could feel the coal ash on [his] skin." He recalled "them telling [the workers] at a safety meeting that the coal ash was safe enough to eat."

Mr. Townsley recalled, as a water truck driver, he "worked in a lot of dust because that is where [he] had to go to wet it down. We had to work hard to try to get [the coal ash] all watered down fast so it did not look dirty for the public. If it was hot and there was wind, [he] would run [him]self to death trying to wet it all down."

Mr. Townsley explained that he "was exposed to the coal ash during [his] lunch breaks as well because [he] would often eat on site." He recalled having to spray out the floorboard inside his truck regularly "because of all the coal ash that got into the truck." He also explained that the coal ash go on his body and his clothes. He stated that he "tried to wash it out of [his] clothes and kept his work clothes separate from [his] other clothes," but that he "had to throw [his work clothes] away eventually." He testified during his deposition that there were no effective places to clean his clothes off at the Kingston site. He recalled that there were boot washing stations "for 100 men to wash their boot[s] off in." He explained that at the end of the day "[they] had ash all over [them]. It was in your nose, your ears, your eyes, your hair, all over your clothes. . . . you had it everywhere. There wasn't no where to clean up at. You'd just wash your boots." He further explained, "You get [the coal ash] on you even in the truck. It's coming through the vents. Then when you get out and use the restroom, it's – the ash was everywhere. It's blowing everywhere. The only time the ash wasn't blowing is when it was pouring down rain."

Mr. Townsley explained that he did not wear a mask while working on the Kingston site. He testified during his deposition that the workers knew not to request to wear a mask, or else they would be fired. He explained, "I didn't request nothing because I wanted to work. . . . Just you don't stir nothing up because you ain't going to stay there long. They'll fire you." He further recalled "that Jacobs told [workers] they didn't need a dust – or any kind of mask."

Based on the foregoing, it is my scientific opinion that Jeff Townsley, more likely than not, was exposed by inhalation and ingestion to a long-term, continuous, and high intensity dose of coal fly ash during his employment at the Kingston site sufficient to result in numerous negative health effects as supported by the scientific literature.

**ADDENDUM 43: Individualized Exposure Assessment of Timothy Turner**

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by Timothy Turner at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; and Theron Blickenstaff, MD.

**Materials Reviewed:**

With regard to Mr. Turner, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff Timothy Turner's Responses to Interrogatories;
- Employment Records for Timothy Turner;
- Personal Air Monitoring Data;
- August 13, 2020 Deposition of Fred C. Jones; and
- August 10, 2020 Deposition of Timothy Turner.

**Timothy Turner's Work at the Kingston Coal Ash Recovery Site:**

Union records indicate that Mr. Turner was employed by GUBMK from February 2010 to August 2014. Mr. Turner estimates that he worked on the Kingston site from February 26, 2010 to August 2014. Mr. Turner worked as a truck driver, driving an articulated dump truck and a water truck on and around the Kingston site during that period. Mr. Turner estimates that he regularly worked up to seven days a week for approximately ten per day, or more due to overtime, but he estimates that he may have worked less after working on the site for some time.

**Sampling and Testing Relevant to Timothy Turner's Work:**

Based on his work history, sampling collected in the following SEGs is relevant to Mr. Turner: Articulated Dump Truck Operator, Water Truck Operator. The highest measured concentrations in each SEG are summarized in the table below.

| SEG and year | Total Dust (µg/m$^3$) | Resp. PM (µg/m$^3$) | Silica (µg/m$^3$) |
|---|---|---|---|
| Artic Dump Truck Operator | | | |
| 2009 | 390 | 260 | 13 |
| 2010 | 350 | <42 | <8 |
| 2011 | | 200 | 17 |
| 2012 | | 120 | 13 |
| 2013 | | 62 | |
| 2014 | 200 | | |
| Water Truck Operator | | | |
| 2009 | 170 | | |
| 2010 | 380 | 109 | |
| 2011 | | 320 | 24 |
| 2012 | | 150 | 10 |
| 2013 | | 280 | |
| 2014 | | 58 | |

These sample results indicate a repeated, substantial exposure to workers in Mr. Turner's SEGs. The highest measured RPM concentration, 320 µg/m$^3$, is approximately 30 times higher than the likely ambient background $PM_{2.5}$ concentration, indicating a substantial exposure to airborne fly ash. The highest measured exposure to silica, a human carcinogen, 24 µg/m$^3$, is just slightly less than the ACGIH TLV® of 25 µg/m$^3$. The fact that Mr. Turner worked significant overtime makes his substantial exposures even more serious; if, for example, he worked 80 hours per week rather than 40 it would have doubled his total dose from inhalation and ingestion and reduces the silica TLV® from 25 to 12.5 µg/m$^3$, and then 4 of the 6 silica measurements in the above table would have exceeded the TLV®.

In addition to the air sampling described above, we can look to indirect evidence for his exposures.

**Evidence of Timothy Turner's Exposure:**

Mr. Turner has described his exposure to coal ash while working at the Kingston site. For example, in responding to interrogatories, he explained that "[t]he coal ash got all over [him]" and "got all over [his] boots, clothes, hands, arms, and [his] exposed skin" and "even get in [his] hair, ears, nose, and mouth." He recalled that the coal ash would get in his nose "so badly that when [he] blew [his] nose, black mucus would come out." He further recalled that the coal ash was "so bad" that when he would remove his safety glasses from his pocket, "they were all covered in ash."

Mr. Turner stated that "[c]oal ash got all over [his] work clothes and personal items." While working on the site, "the ash got all over the outside of [his] truck because the ash was all in the air and stirring up everywhere on the site." The ash would even get inside the cab of his truck. He explained that the inside of his cab "was always really dusty. [He] could even see the ash floating around in the cab with [him]." He recalled removing the filter from his truck and noticed that it "was all caked up with ash." During his deposition, Mr. Turner testified that the coal ash would even get into his personal truck and he would have to clean it out every week. He also recalled the coal ash covering his clothes, which required him to wash them every day.

During his deposition, Mr. Turner testified that he did not wear a mask or respirator while working at the Kingston site. However, he explained that he had been told that "if [he] asked for a respirator, [he] would be laid off." He recalled that he wore a personal air monitor while working at the site on at least one occasion, but as he stated, "[i]t was usually more rain when they" collected personal air monitor samples from the workers.

Based on the foregoing, it is my scientific opinion that Timothy Turner, more likely than not, was exposed by inhalation and ingestion to a long-term, continuous, and high intensity dose

of coal fly ash during his employment at the Kingston site sufficient to result in numerous negative health effects as supported by the scientific literature.

**ADDENDUM 44: Individualized Exposure Assessment of Donald Vangilder, Jr.**

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by Donald Vangilder, Jr. at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; C. Ola Landgren, MD, PhD; and Raajit Rampal, MD, PhD.

**Materials Reviewed:**

With regard to Mr. Vangilder, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff Donald Vangilder's Responses to Interrogatories;
- Personal Air Monitoring Data;
- November 10, 2020 Declaration of Farie Becker;
- November 10, 2020 Declaration of Donald Vangilder;
- August 4, 2020 Deposition of Donald Vangilder.

**Donald Vangilder's Work at the Kingston Coal Ash Recovery Site:**

Mr. Vangilder, as well as Farie Becker, estimate he worked on the Kingston site from June 2011 to September 2011. Mr. Vangilder worked as a truck driver, driving a triple axel dump truck on or around the Kingston site during that period. Mr. Vangilder also explained that he was "kind of a truck boss," which required him to walk around the site interfacing with other workers. In particular, Mr. Vangilder drove a truck hauling coal ash, dirt, and other materials on and around

the site. Mr. Vangilder and Farie Becker estimate that he regularly worked up to seven days a week for approximately twelve hours per day during this period from June 2011 to September 2011.

**Sampling and Testing Relevant to Donald Vangilder's Work:**

Mr. Vangilder's work history indicates that he worked in the Dump Truck Operator SEG. The highest measured concentration in each year for this SEG are shown in the following table.

| SEG and year | Total Dust ($\mu g/m^3$) | Resp. PM ($\mu g/m^3$) | Silica ($\mu g/m^3$) |
|---|---|---|---|
| Dump Truck Operator | | | |
| 2009 | 360 | 260 | 13 |
| 2010 | | 95 | |
| 2011 | | 51 | |
| 2012 | | 36 | |

The sample results show that dump truck drivers such as Mr. Vangilder were consistently exposed to airborne RPM concentrations that were elevated, with the highest value about 25 times higher than the prevailing background $PM_{2.5}$ concentration, indicating a substantial exposure to airborne fly ash. The fact that Mr. Vangilder worked significant overtime makes his substantial exposures even more serious; if, for example, he worked 80 hours per week rather than 40 it would have doubled his total dose from inhalation and ingestion and reduced the silica TLV® from 25 to 12.5 $\mu g/m^3$, and then the silica measurement in the above table would have exceeded the TLV®.

In addition to the air sampling described above, we can look to indirect evidence for his exposures.

**Evidence of Donald Vangilder's Exposure:**

Mr. Vangilder has described his exposure to coal ash while working at the Kingston site. For example, in responding to interrogatories, he explained that there was a "constant cloud of [coal] ash at the Kingston site. He noted that "like that all the time" and became "really bad when all the trucks were driving around at once kicking more ash up into the air." He recalled that coal

ash "covered everything on that site, including the people, trailers, trucks, and equipment." He stated that "[w]hen the ash settled on things, they turned grey."

Mr. Vangilder explained, "The coal ash got all over [his] body, [his] personal belongings, and [his] truck. It would cover [him] from head to toe. The ash got all down in [his] ears, in [his] fingernails, in [his] hair on [his] head, and all over any of [his] exposed skin including all down [his] arms." He noted that his "work clothes got dirty really quickly each day" while at the Kingston site. He stated that his "girlfriend had to wash [his work clothes] frequently to get as much ash off as she could." He recalled that their washing machine broke from washing his ash-covered work clothes.

Mr. Vangilder stated that the coal ash "would get all over the outside and inside of my truck." He explained that coal ash "came in through [the truck's] windows and got all in the cab." Mr. Vangilder recalled "constantly wiping the seats, the dash, the floor, and the windshield off, but it stayed dusty the whole time." He recalled that the coal ash would collect in a thick layer and that he "could not see the gauges on the dashboard," which he regularly had to wipe clean. He further stated that he regularly washed his truck on the Kingston site, but that doing so did not clean the coal ash off his truck. As he put it, "[w]hen water dried on my truck, it dried grey."

Mr. Vangilder's girlfriend, Farie Becker, recalled that "dust got all over [Mr. Vangilder] and his clothes" from working at the Kingston site. She explained that when Mr. Vangilder returned home each day from working at the Kingston site, she could see "dust on his face and in his ears, fingernails, and hair[; d]ust was all over his exposed skin[; d]ust got all over his clothes."

Based on the foregoing, it is my scientific opinion that Donald Vangilder, more likely than not, was exposed by inhalation and ingestion to a dose of coal fly ash during his employment at

the Kingston site that was of sufficient intensity and duration so as to result in numerous negative health effects as supported by the scientific literature.

**ADDENDUM 45: Individualized Exposure Assessment of Michael Watkins**

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by Michael Watkins at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; and Theron Blickenstaff, MD.

**Materials Reviewed:**

With regard to Mr. Watkins, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff Michael Watkins' Responses to Interrogatories;
- Personal Air Monitoring Data;
- Employment Records for Michael Watkins; and
- October 16, 2020 Deposition of Michael Watkins.

**Michael Watkins' Work at the Kingston Coal Ash Recovery Site:**

Union records indicate that Michael Watkins was employed by GUBMK from September 27, 2011 to August 9, 2013, in October 2013, and in May 2014. Union records also indicate that Mr. Watkins was employed by Ash Management Services from October 30, 2013 to December 20, 2013. Mr. Watkins estimates that he worked on the Kingston site from June 2011 to May 2014. Mr. Watkins worked as an operator, operating heavy equipment on and around the Kingston site during that period. Mr. Watkins estimates that he regularly worked four days a week for approximately ten hours per day, or more due to overtime, during his first year at the site, he

estimates that he regularly worked five to six days a week for approximately ten hours per day, or more due to overtime, following that.

**Sampling and Testing Relevant to Michael Watkins' Work:**

Based on his work history, air sampling done for the SEGs Excavator Operator and Dozer Operator are relevant to Mr. Watkins' work at the Kinston site. The highest measured concentrations in each SEG are summarized in the table below.

| SEG and year | Total Dust ($\mu g/m^3$) | Resp. PM ($\mu g/m^3$) | Silica ($\mu g/m^3$) |
|---|---|---|---|
| Excavator Operator | | | |
| 2009 | 210 | 69 | |
| 2010 | 1400 | | |
| 2011 | | 690 | 18 |
| 2012 | | 520 | |
| 2013 | | 1100 | 7 |
| Dozer Operator | | | |
| 2009 | 1300 | 210 | 18 |
| 2010 | 930 | 58 | |
| 2011 | | 200 | 26 |
| 2012 | | 77 | |
| 2013 | | 61 | |

These measurements indicate very high exposures to Mr. Watkins' SEGs. The TPM measurements represent very high exposures to total particle mass, and the RPM measurements for the Excavators in 2011-2013 are very high, approximately 50 – 100 times higher than the prevailing background $PM_{2.5}$ concentration, indicating a substantial exposure to airborne fly ash. The highest measured concentration for silica, a human carcinogen, exceeds the ACGIH TLV® of 25 $\mu g/m^3$. The fact that Mr. Watkins worked significant overtime makes his substantial exposures even more serious; if, for example, he worked 80 hours per week rather than 40 it would have doubled his total dose from inhalation and ingestion and reduces the silica TLV® from 25 to 12.5 $\mu g/m^3$, and then 3 of the 4 silica measurements in the above table would have exceeded the TLV®.

In addition to the air sampling described above, we can look to indirect evidence for his exposures.

**Evidence of Michael Watkins' Exposure:**

Mr. Watkins has described his exposure to coal ash while working at the Kingston site. For example, in responding to interrogatories, he explained that "[c]oal ash was constantly everywhere" on the Kingston site, and that the workers "were always coated in it." As he put it, "[y]ou could not get away from the coal ash." He stated that "[a]nything that sat out would be covered in coal ash within minutes." He recalled being able to feel the coal ash on his.

Despite the coal ash being "everywhere," Mr. Watkins explained that there were no effective ways for the workers to clean themselves off. He recalled that there were boot washing stations on the Kingston site, but they were "pointless" because "[b]y the time 3 people used the boot wash, you would just be slopping your boots in pure coal ash because there was no way to change the water." He explained that the area where the workers ate their lunches was "completely coated in coal ash . . . [and t]here was always coal ash in [his] food and on [his] water bottles no matter where [he] tried to eat."

Mr. Watkins further explained that "[a]t the end of the shifts, [the workers] did not have anywhere to get cleaned off" before going home. He testified during his deposition that he would be "covered in ash" at the end of the workday, and that his personal truck became "coated in coal ash, and [he] had no way to clean it out." When he returned home each day after working at the Kingston site, he would take his clothes off and "keep everything separate" to prevent coal ash from his work clothes getting all over his home. However, he recalled that there were still "coal ash stains all over [his] house." He explained that he would blow his nose and "it would come out completely black."

Mr. Watkins stated that he did not wear a mask while working on the Kingston site. He explained that all the workers "knew that if you asked for a mask, you would be denied or fired." He personally "never asked for a mask because [he] knew it was discouraged." He testified during his deposition that Tom Bock, a Jacobs Engineering Group, Inc. employee, "said you could eat a pound of [coal ash] a day, [and] there wasn't nothing in it that would hurt [the workers]." He further recalled that Mr. Bock "joked about it all the time like it was[] nothing, said nothing out there [on the Kingston site] would hurt" the workers. Mr. Watkins also testified that he was "laid off shortly after" "report[ing] medical issues to Mr. Bock."

Based on the foregoing, it is my scientific opinion that Michael Watkins, more likely than not, was exposed by inhalation and ingestion to a long-term, continuous, and high intensity dose of coal fly ash during his employment at the Kingston site sufficient to result in numerous negative health effects as supported by the scientific literature.

**ADDENDUM 46: Individualized Exposure Assessment of Craig Wilkinson**

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by Craig Wilkinson at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; and Eugene Shostack, MD.

**Materials Reviewed:**

With regard to Mr. Wilkinson, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff Craig Wilkinson's Responses to Interrogatories;
- Personal Air Monitoring Data; and
- October 11, 2018 Deposition of Craig Wilkinson.

**Craig Wilkinson's Work at the Kingston Coal Ash Recovery Site:**

Mr. Wilkinson estimates that he worked on the Kingston site from April 2009 to May 2010. Mr. Wilkinson worked several jobs on the Kingston site, including as a heavy equipment operator, driving track hoe, an excavator, and a bulldozer in and around the exclusion zone at the Kingston site during that period. Mr. Wilkinson estimates that he worked up to seven days a week for approximately twelve hours per day, or more due to overtime, during this period from April 2009 to May 2010.

**Sampling and Testing Relevant to Craig Wilkinson's Work:**

Based on his work history, air sampling done for the SEGs Excavator Operator and Dozer Operator are relevant to Mr. Wilkinson's work at the Kinston site. The highest measured concentrations in each SEG are summarized in the table below.

| SEG and year | Total Dust (µg/m³) | Resp. PM (µg/m³) | Silica (µg/m³) |
|---|---|---|---|
| Excavator Operator | | | |
| 2009 | 210 | 69 | |
| 2010 | 1400 | | |
| 2011 | | 690 | 18 |
| 2012 | | 520 | |
| 2013 | | 1100 | 7 |
| Dozer Operator | | | |
| 2009 | 1300 | 210 | 18 |
| 2010 | 930 | 58 | |
| 2011 | | 200 | 26 |
| 2012 | | 77 | |
| 2013 | | 61 | |

These measurements indicate very high exposures to these SEGs. The TPM measurements represent very high exposures to total particle mass, and the RPM measurements for the Excavators in 2011-2013 are very high, approximately 50 – 100 times higher than the prevailing background $PM_{2.5}$ concentration, indicating a substantial exposure to airborne fly ash. The highest measured concentration for silica, a human carcinogen, exceeds the ACGIH TLV® of 25 µg/m³.

In addition to the air sampling described above, we can look to indirect evidence for his exposures.

**Evidence of Craig Wilkinson's Exposure:**

Mr. Wilkinson has described his exposure to coal ash while working at the Kingston site. For example, in responding to interrogatories, he recalled that the coal ash—or fly ash, as Mr. Wilkinson called it—was "everywhere" and that he "could see the fly ash in the air." Mr. Wilkinson noted that he worked night shift and stated that "[a]t night, [he] could see the ash

floating in the air in the beams from our lights on the [Kingston] site. The ash particles were like little pieces of glitter." He explained, "Trying to keep the site clean was an endless battle. The water trucks were running a lot trying to keep the dust down, but the ash dried out so quickly."

Mr. Wilkinson noted that he drove various equipment on and around the Kingston site, completing various jobs throughout the site during his time there. He explained that he "processed and flipped fly ash to dry it out, . . . pat[ting] and dip[ping] . . . the water out of the ash they had dredged up," and that he also "worked at the receiving end of the pipe that pumped the ash from the river." In short, Mr. Wilkinson worked directly with, or otherwise in very close proximity to, the coal ash as it was being removed from the water and was being processed.

Mr. Wilkinson also explained that he "walked around the site often" as part of his job. He recalled that "[t]he fly ash was everywhere." He recalled that the coal ash "got all over [him] and all of [his] belongings" and regularly "got all over [his] clothes and boots." He explained that the coal ash was "all over [his] body" and "got in [his] mouth and all over [his] face." He recalled that he "could taste [the coal ash] in [his] mouth" and the ash "collected in [his] ears and nose."

Mr. Wilkinson explained that he did not wear a mask on the Kingston site, explaining that they were not available. In his deposition, he testified that he would have worn one if provided. However, he explained that provided the dust mask was a "red flag," and indicated that he believed masks were not provided so the workers would "not really [] worr[y] about it." As he put it, "they sure weren't handing [masks] out" to the workers on the Kingston site.

Mr. Wilkinson explained that although he worked mostly in the cab of his heavy machinery, "fly ash still got all in the machine and on [him]." He recalled that ash "got all over the floor of the cab from falling off [his] boots." He testified during his deposition that he had a "brand-new machine" but that it quickly became covered with coal ash in the cab. He explained

that he would attempt to sweep up the ash, it would "cover [his] face." He recalled that the coal ash would regularly "kick up in the air and float around the cab," becoming airborne. Mr. Wilkinson explained that the coal ash "covered the inside and the outside" of his machinery. He noted that he had to "clean out the machines at the end of our shifts" due to the coal ash, and that he had to "clean the filters for the cab because they were always plugged up with coal ash."

Mr. Wilkinson explained that he ate his lunch in a trailer, but noted that the trailer "was also covered in fly ash." He recalled that there were boot washing stations on the site. "However, they did not work very well at all. After a few workers use them, the trays were filled with dirty water." He testified that the boot washing station was so ineffective that, if anything, if simply "spread [coal ash] around your boot." He noted that he "tracked [coal ash] into [his] car and home," regardless of how much he attempted to clean it off at the site. He recalled that his work clothes were regularly "caked up" with coal ash, and that the ash would even get on the inner layer of his clothing. He recalled that his work clothes were "so dirty that [he] had to take off [his] clothes in a special place by the door when [he] got home after working at Kingston." He recalled that his brother, who also worked at the Kingston site, likewise removed his dirty clothes near the door. Mr. Wilkinson explained that "[t]he floor and area where we took off our clothes had spots from the ash collecting there every day."

Based on the foregoing, it is my scientific opinion that Craig Wilkinson, more likely than not, was exposed by inhalation and ingestion to a long-term, continuous, and high intensity dose of coal fly ash during his employment at the Kingston site sufficient to result in numerous negative health effects as supported by the scientific literature.

**ADDENDUM 47: Individualized Exposure Assessment of Jason Williams**

This Addendum and the opinions expressed herein are intended to supplement my comprehensive report of December 7, 2020.

The following shall serve as my individualized assessment as to the exposures to coal fly ash experienced by Jason Williams at the Kingston Coal Ash Remediation Site (the "Kingston site") and the likelihood that said exposures could result in negative health effects as supported by the scientific literature, as well as the expert reports of Elizabeth Ward, PhD; Joseph Graziano, PhD; Norman Kleiman, PhD; and Theron Blickenstaff, MD.

**Materials Reviewed:**

With regard to Mr. Williams, I have reviewed the following documents, in addition to the documents listed in my attached report:

- Plaintiff Jason Williams' Responses to Interrogatories;
- Personal Air Monitoring Data; and
- August 11, 2020 Deposition of Jason Williams.

**Jason Williams' Work at the Kingston Coal Ash Recovery Site:**

Mr. Williams estimates that he worked on the Kingston site from May 2011 to January 2015. Mr. Williams worked as a truck driver, driving on and around the Kingston site during that period. Mr. Williams estimates that he worked up to seven days a week for approximately sixty hours per week, or more due to overtime, during this period from May 2011 to January 2015.

**Sampling and Testing Relevant to Jason Williams' Work:**

Mr. Williams' work history indicates that he worked in the Dump Truck Operator SEG. The highest measured concentration in each year for this SEG are shown in the following table.

| SEG and year | Total Dust ($\mu g/m^3$) | Resp. PM ($\mu g/m^3$) | Silica ($\mu g/m^3$) |
|---|---|---|---|
| Dump Truck Operator | | | |
| 2009 | 360 | 260 | 13 |
| 2010 | | 95 | |
| 2011 | | 51 | |
| 2012 | | 36 | |

The sample results show that dump truck drivers such as Mr. Williams were consistently exposed to airborne RPM concentrations that were elevated, with the highest value about 25 times higher than the prevailing background $PM_{2.5}$ concentration, indicating a substantial exposure to airborne fly ash. The fact that Mr. Williams worked significant overtime makes his substantial exposures even more serious; if, for example, he worked 80 hours per week rather than 40 it would have doubled his total dose from inhalation and ingestion and reduced the silica TLV® from 25 to 12.5 $\mu g/m^3$, and then the silica measurement in the above table would have exceeded the TLV®.

In addition to the air sampling described above, we can look to indirect evidence for his exposures.

**Evidence of Jason Williams' Exposure:**

Mr. Williams has described his exposure to coal ash while working at the Kingston site. For example, in responding to interrogatories, he explained that the coal ash "was always floating in the air" at the Kingston site, and that "the coal ash got all over [him]." He stated that the coal ash "would cover anything on the site including [his] body, [his] truck, and all [his] personal stuff." He stated that "[t]he ash got on [his] head, arms, neck, hands, and any other exposed skin," which would cause him to "break out" and develop "rashes all over from where [his] skin was exposed to the coal ash." He recalled the coal ash getting "in [his] fingernails, ears, and nose," and when he blew his nose, "black stuff went everywhere."

Mr. Williams explained that the coal ash regularly covered his truck on the Kingston site, causing his yellow truck to "look[] grey." He also explained that coal ash got inside his truck and "covered everything including the dash, windshield, seats, and steering wheel." He recalled having "to constantly wipe the cab down because it got so dusty," and it would become "difficult to see inside the cab because there was always a film on the window and the dashboard no matter how much [he] cleaned it." As he stated, "[t]he floorboards were covered in ash from [his] boots." He explained, "It was even worse when [he] had to leave the truck, walk around the site, and get back in with [his] boots covered in more ash."

Mr. Williams recalled that he "sometimes had to eat lunch in [his] truck and the ash would get on [his] food." He testified that when he left the Kingston site at the end of the day, there would "be ash in [his] . . . personal vehicle." When he returned home each day after working at the Kingston site, he removed his clothes immediately "because they were covered in ash." He recalled that his wife washed his work clothes frequently, and that they had to replace their washing machine due to the coal ash. He further explained that when he showered, the coal ash "stained the bottom of [his] shower curtain."

During this deposition, Mr. Williams testified that on at least one occasion Tom Bock, a Jacobs Engineering Group, Inc. employee, told the workers that they "could eat a pound of [coal ash] a day and you'd be okay." Mr. Williams explained that he simply trusted that coal ash was safe. He testified that he did not wear a mask while working at the Kingston site. He further testified that "when someone did ask to wear a dust mask [on the site]," Tom Bock, a Jacobs Engineering Group, Inc. employee, told the workers that they were not "allowed to wear them." Further, he stated that Mr. Bock said, "If we got caught wearing [a mask], we could get fired" and

that wearing a mask would "look bad for the community." Mr. Williams explained that, "[a]s far as [he] kn[e]w, you couldn't wear [as mask]" on the Kingston site.

Based on the foregoing, it is my scientific opinion that Mr. Williams, more likely than not, was exposed by inhalation and ingestion to a long-term, continuous, and high intensity dose of coal fly ash during his employment at the Kingston site sufficient to result in numerous negative health effects as supported by the scientific literature.